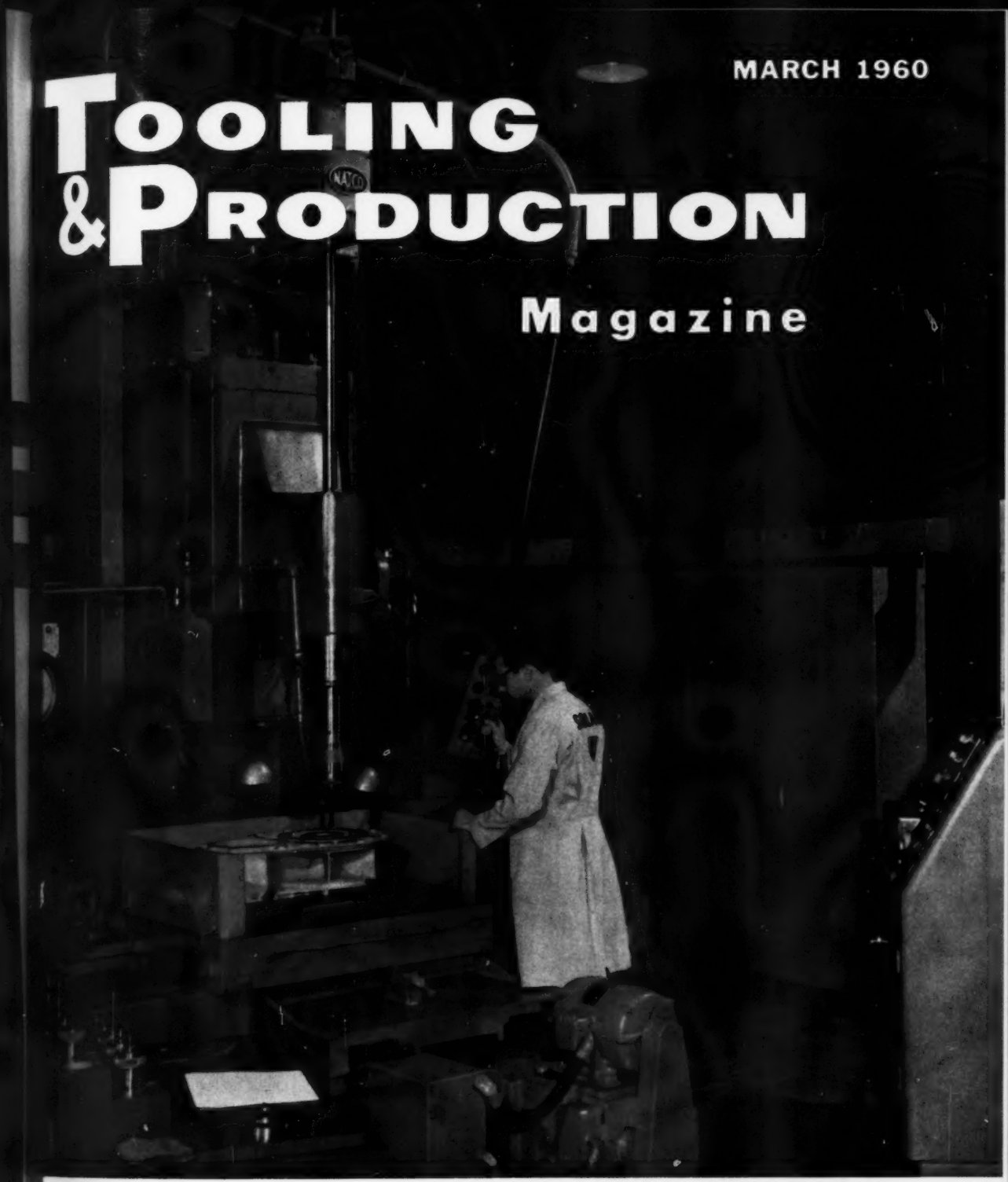
MARCH 1960

TOOLING & PRODUCTION

Magazine



Tape Control Speeds Solar's Turbine Program . . . page 55

Heat Treatment of Tool Steels . . . page 51

Innovations in Progressive Die Design . . . page 57

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. . . Inside Cover

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CIRCLE INFORM-A-GRAM KEY NO. 2

TOOLING & PRODUCTION Magazine

VOL. XXV, No. 12

MARCH 1960

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BPA

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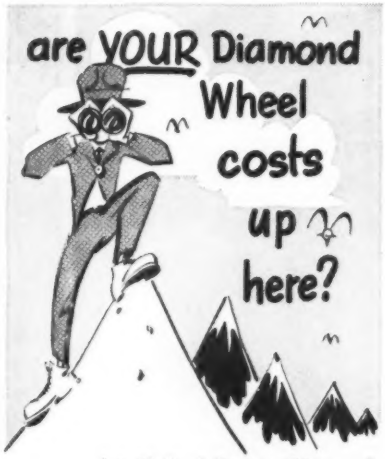

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CIRCLE INFORM-A-GRAM KEY NO. 4

MARCH 1960
VOL. XXV No. 12
GEORGE J. HUEBNER, Founder
1885 - 1956

personally speaking ...

Dear T & P Reader:

This year of 1960 will certainly end up being remembered as The Year of Shows. At least it looks that way for those of us in the metalworking industry.

April starts the ball rolling with The Tool Show in Detroit. This will be held in the Detroit Artillery Armory, a former war plant, located on the Eight Mile Road nine to ten miles out from downtown Detroit.

Then comes the Machine Tool Exposition which will be held in September at the Chicago Amphitheatre and Exposition Hall. Please note that this is not a "show"; it is an "exposition." The word "exposition," we understand denotes "non-profit." The Machine Tool Exposition is sponsored by the National Machine Tool Builders' Association. Running concurrently in Chicago, on the Municipal Pier, and with the blessing of the sponsor of the Machine Tool Exposition, will be the so-called Production Engineering Show, privately sponsored. Riding on the coattails of both these shows and without the blessing of either will be the "second" Coliseum Machinery Show.

This fall's Metals Show will be held in Philadelphia in October. And it will be a good one, too, in case you are not worn out from the three September shows, and haven't spent all of your money and would like to go to Philadelphia. And in November you have a chance to go to California (unless you are already there) because that will be the opportunity afforded you by a second 1960 Tool Show under the same sponsorship as the April 1960 Detroit Tool Show.

My real purpose in telling you about these shows is to leave with you a few helpful suggestions. If you go to any of them, plan the amount of time of your visit and then double it. For example, the Tool Show in Detroit will have about 500 exhibitors. If you go there to look at things seriously, there will be so much of interest that you will desperately need more time than you plan to spend. Even then, you will find it extremely important to plan your trip through the show so that you surely see what you want to see. The same goes for the shows in Chicago. It's a little early to tell just how many exhibitors there will be but it's very probable that there will be at least 500 between the three shows, which are widely spaced as far as geography is concerned. As for the other two shows in Philadelphia and California, the planned visit suggestion is equally pertinent.

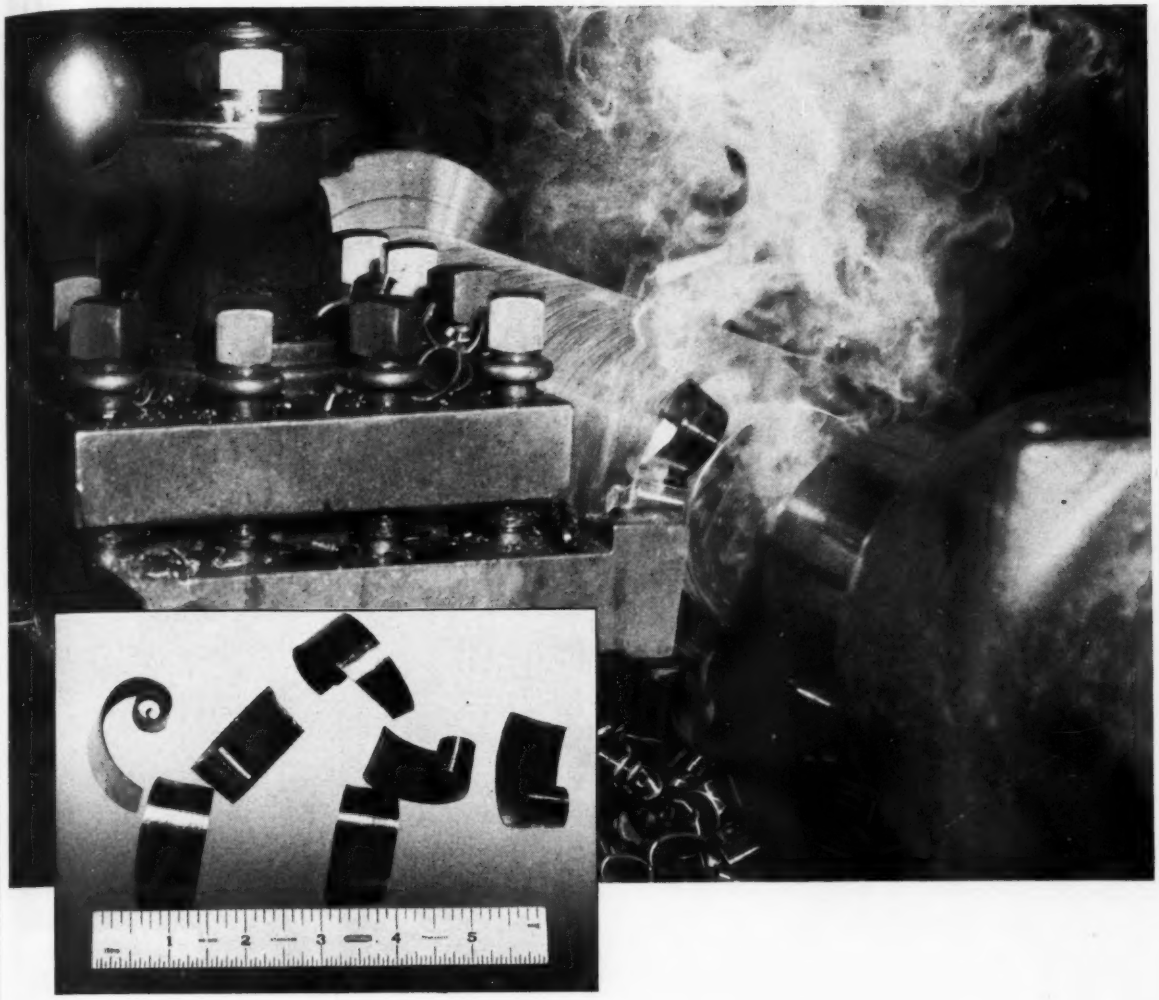
To plan what you are going to see at any of these shows, watch the pages of Tooling & Production Magazine for information on what is to be on display. We will attempt to call your attention especially to the new products. At the same time it must be remembered that many products which have existed for a long time can hold potential interest for you. We'll call your attention to many of these also. And you'll want to watch advertisements because they will be very helpful in aiding you to make selections of what you want to see. Of course, there is nothing wrong with going to one of these shows simply on a rubber-necking expedition. But I've heard many show visitors who have done this say afterward, "I wish I'd seen this or that or the other thing." The only way you can be sure that you see 'most everything you want to see is by planning ahead.

We wish you successful shopping at these industrial shows. If there is anything we can do to help make your visits more worthwhile for you, please tell us.

Cordially yours,

Ray Huebner

Publisher



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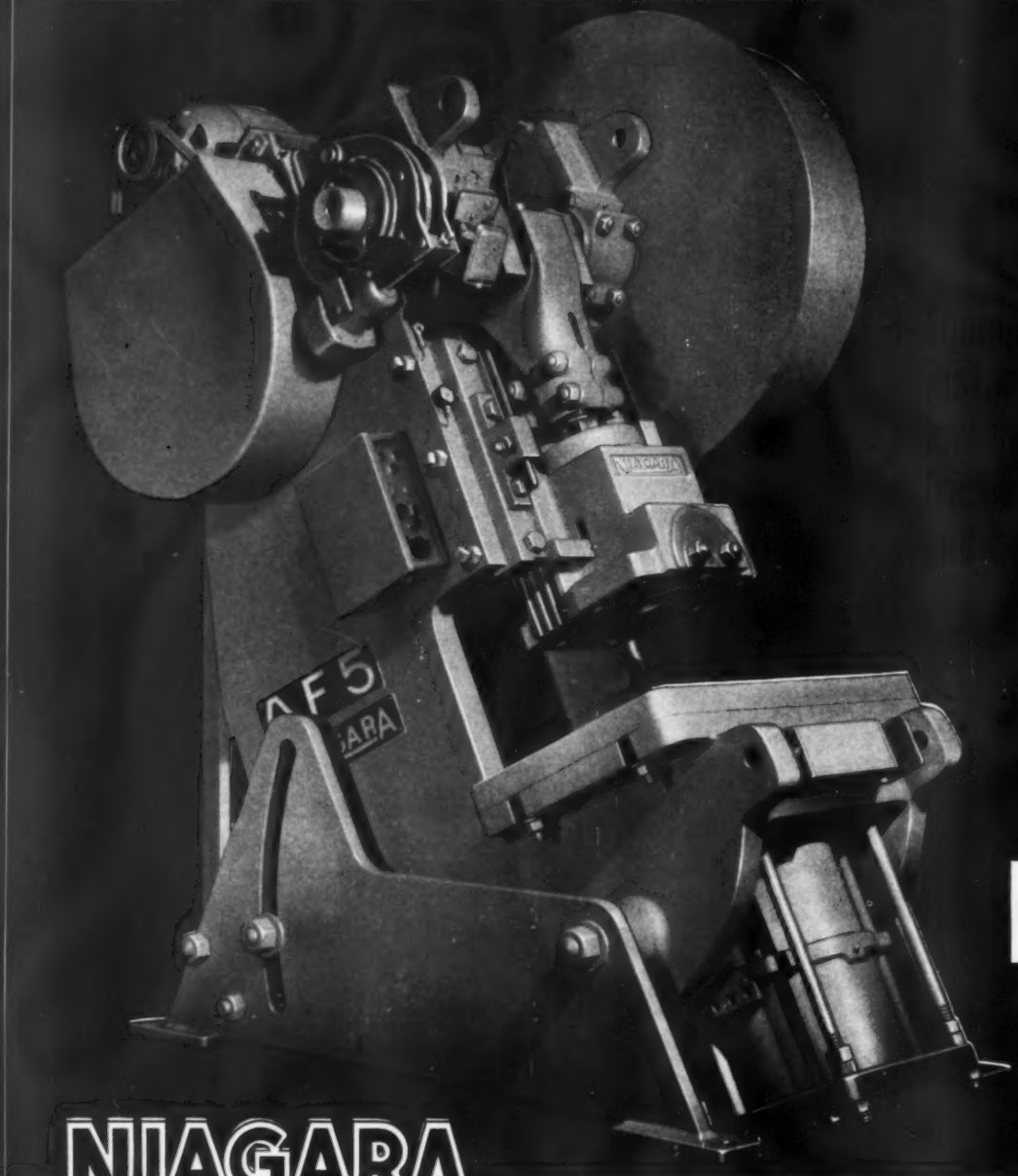

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CIRCLE INFORM-A-GRAM KEY NO. 6

Talk of the Month

The Businessman's Leadership Role In Political Action

by Merritt D. Hill

THROUGH YOUR BUSINESS activity you have earned a position of economic leadership in your community. In doing this, I am sure you have already learned that the inevitable price of success, or privilege of success, if you will, is increased responsibility, particularly increased social responsibility.

As successful businessmen in a society based on a business economy, many of you have been asked to add civic leadership to economic leadership. The businessman's record of response to these appeals is remarkably good. He has tackled hospital drives, United Fund campaigns, and other worthwhile civic enterprises with energy and vigor. However, there remains another area of community life that businessmen approach warily and reluctantly, if at all. This is the area of political action.

This month's "Talk" is excerpted from an address by Mr. Hill, vice president and general manager of the Tractor & Implement Div'n, Ford Motor Company, at the recent annual convention of the Cutting Tool Manufacturers Association in Detroit.

Outspoken as he may be in working for his company, and vigorous as he is in promoting health, welfare, culture, and educational enterprises for his community, the businessman typically becomes "quiet as a mouse," at least in public, when politics are mentioned.

Now is the time to banish these unfounded fears and elevate political consciousness to the same level as community consciousness.

Our Constitution assures us that our government should belong to everyone. But practical politics changes that. Government "belongs" to the segment or segments of society that practice practical politics best. And a large segment of American society — people who make their living as employees and managers — have shunned politics.

Consequently, elements that are unable to comprehend or refuse to recognize the conditions that must be present to keep our type of economic system dynamic have

. . . Continued on page 10

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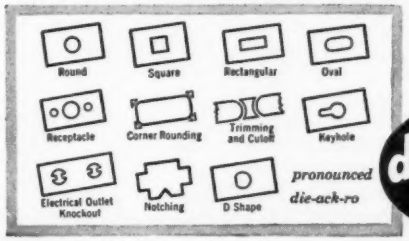

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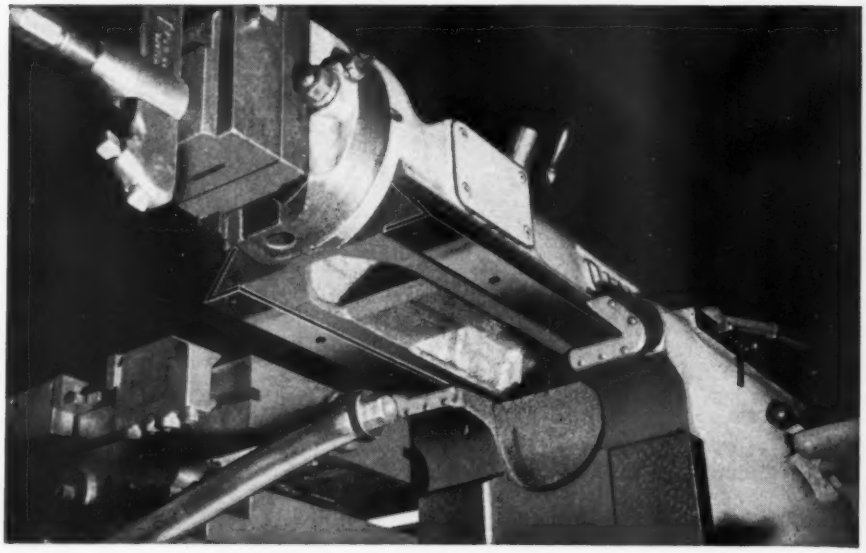

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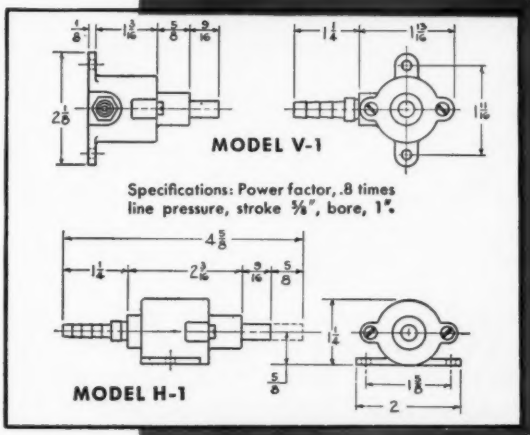

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CIRCLE INFORM-A-GRAM KEY NO. 9

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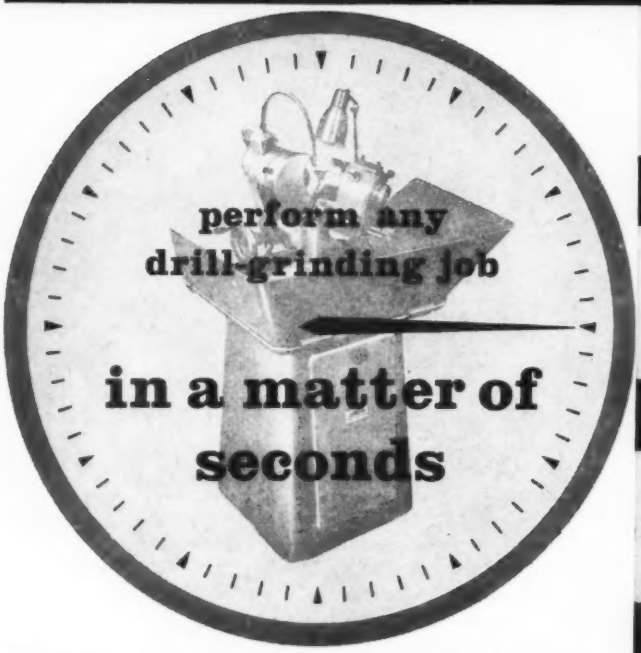

Right hand twist drill, with centre

Twist drill for soft material, lips corrected

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Spot facing cutter, angle 180°

Screw tap, grinding of the angle of rake

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CIRCLE INFORM-A-GRAM KEY NO. 10

. . . Month's Talk from page 7

more than a proportionate share in helping formulate legislation. The time has come, in short, for businessmen to make government and politics their business.

I should like to make it very clear, here, that I do not advocate that businessmen become active in politics to counteract the political activity of the labor union leaders. Rather, the reason should be better government and an attempt to make a constructive contribution to the goals for which all of us in America are eager.

When businessmen talk of engaging in politics, it is sometimes assumed that they mean sponsorship of a Business Party. This is by no means the case. There is no single unanimously accepted business program and it is highly unlikely that there ever will be. The development I speak of is not a "business in politics" movement, but more accurately it should be called a program for businessmen in politics. Actually such a movement should not be confined to businessmen alone. It should, and if it is to be completely successful, it must, include individual citizens of every kind and in every occupation.

I want to make it a matter of record, also, that I do not advocate that the whole support of corporations and their money and their influence be lined up behind one political party.

Time for Action

We believe it is time for businessmen to take up their franchise again, enter the party they choose, and strive for a more representative government by making both parties more representative of **all** sections of society. It is time to admit that public affairs **are** a problem of business.

Now I am quite ready to admit that to accomplish this we need to bring about a change in the thinking of a large number of people. However, we need not think that this can't be done.

In fact, many businessmen are changing their thinking and recognizing that they should take a more active interest in political activities . . . . And I believe that

. . . Continued on page 13

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CIRCLE INFORM-A-GRAM KEY NO. 11

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125 STROKES PER MINUTE on a 300 TON PRESS with a 6″ STROKE

This is a lot of strokes per minute for a 300-ton automatic press especially on a part requiring a 6″ stroke. This is one of the reasons why The Budd Company, Philadelphia, chose high production Henry & Wright Dieing Machines. They also needed flexibility for a wide range of short-run jobs; accurate die guiding to assure minimum wear on expensive, multi-stage progressive dies averaging 8-stages each; automatic material feeding and parts ejection; quick and easy die changing . . . all so necessary to stay profitable in the highly competitive stamping business.

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HPM

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CIRCLE INFORM-A-GRAM KEY NO. 12

... Month's Talk from page 10

this awakening to political responsibilities is being realized throughout our whole society and not merely in the plants and offices of business.

The good common sense of the American voter has in the past found the solution to many critical problems. Evidence seems to point up that they are only waiting for leadership to do so again in the present situation.

Briefly, there are three steps we as businessmen can do in our companies to return politics to the people — make politics popular with people, generally; inform people about politics and government; and make political activity convenient for people.

What can we do to make politics popular? Probably our first job — if it has not yet been attended to — is to convince ourselves that the task is necessary. Develop, first, a genuine appreciation of the importance of government in our lives and a genuine interest in the processes that make government work. Only then will we be able to make politics popular with others.

This is not hard to do. Political and governmental activity can be tremendously exciting and stimulating. You have the companionship of like-minded people. You have the inspiration of a cause. You have the challenge of competition. You have opportunities for careful thought along with the hurly-burly of the campaign and convention. Above all, you have the assurance of vastly important, vastly worthwhile activity. In all ages, some of the most influential men have achieved their accomplishments through politics.

Get Others Interested

Once you have convinced yourselves, what then? The American corporation can play a great part in renewing interest in others. ... Henry Ford II, in a recent address, said:

"It seems to me that the best hope for stopping the present political drift toward a government controlled economy ... lies in the political activation of the large, moderate, politically inactive middle-income group in our society. This group amounts, by one estimate to 30% of the electorate. It is the fastest growing group in the country, composed substantially of white collar and middle management employees. It could be playing a dominant role in politics. If it can be mobilized, it would provide a solid and wholesome buffer to extremes, of either the right or the left."

One of the ways by which Ford plans to mobilize this group is through the activities of its Civic and Governmental Affairs Office. Our program consists of:

- A Civic and Governmental Affairs Committee, composed of top management, that reviews legislative and governmental matters that affect the company and formulates our position in these matters. It also reviews all programs and proposed activities intended to implement the company's interest in such matters.
- A staff of specialists in the Civic and Governmental Affairs Office, including a research department.

... Continued on page 15

2738

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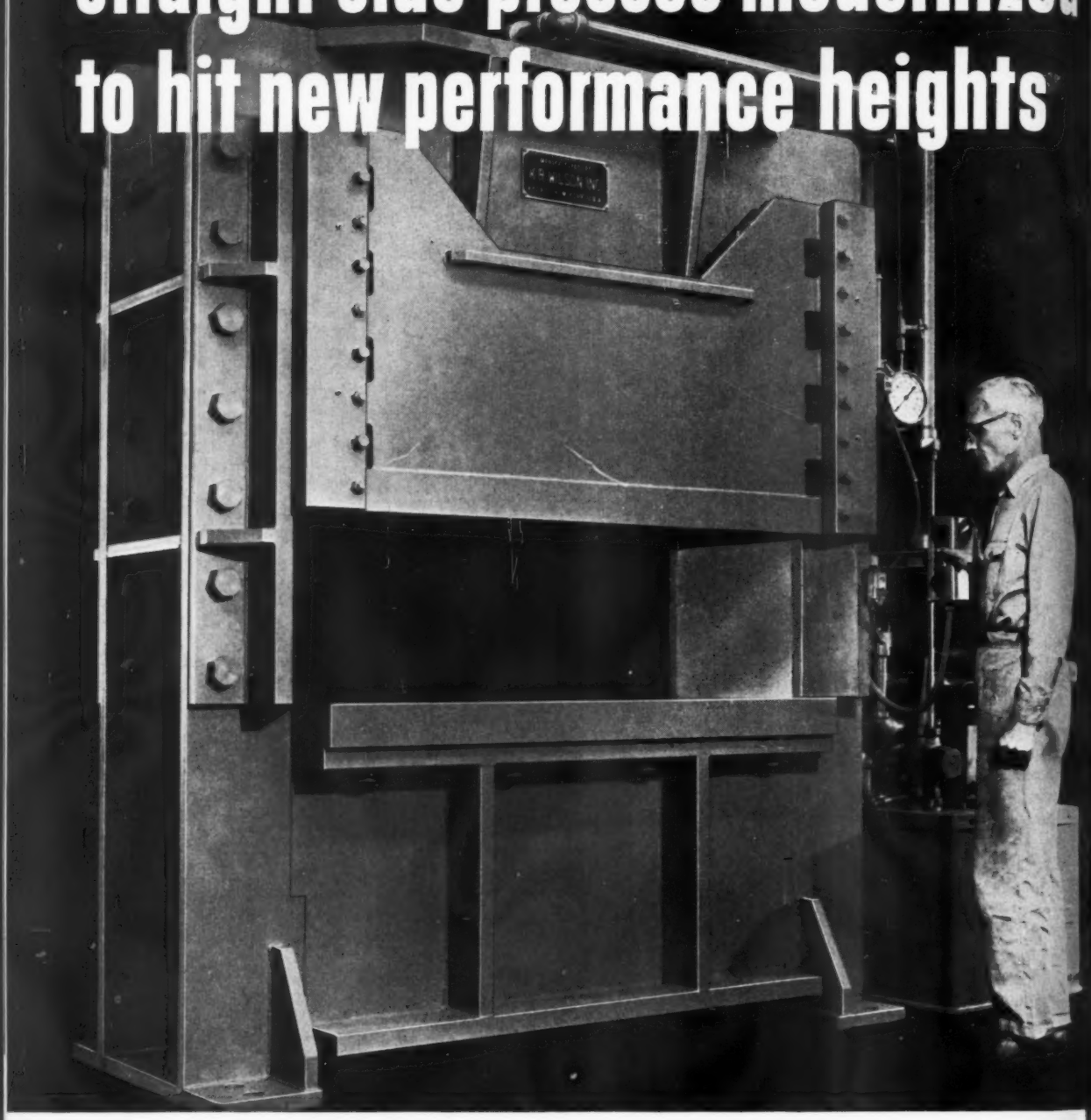
CIRCLE INFORM-A-GRAM KEY NO. 13

straight side presses modernized to hit new performance heights



Here's smooth hydraulic action at its best! Newly modernized, the KRW 25-1000 ton line of straight side, single action presses offers you the most profitable answer to a wide range of work: bending, forming, blanking, briquetting, broaching, coining, embossing, forging, straightening and trimming.

Boasting clean-cut, neat exteriors, these versatile machines have been engineered to improve productivity . . . *quantity-wise, quality-wise and dollar-wise!*

KRW's rugged, welded frame construction is unequalled for strength and rigidity. Members are keyed and fitted together to insure precision performance. Angle gibs, located at each corner of the sliding platen, maintain platen-to-bed parallelism to make utmost accuracy and longer die life a certainty.

Available with either up-acting or down-acting platens, KRW Straight Side, Single Action Presses can be outfitted with manual lever or electric push buttons for single or continuous cycling. Compact, easy-to-adjust and fully responsive, KRW hydraulic systems assure instant, complete press control.

More detailed information (including specs) can be obtained by writing for illustrated Bulletin 5-B. K. R. Wilson, Inc., 218 Main St., Arcade, N. Y.

KRW HYDRAULIC PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 14

... Month's Talk from page 13

• A regional organization of eight offices, manned by regional managers who have a particular knowledge of the region in which they serve. One of their functions is to give direct assistance to local company management in civic and governmental matters.

• A program of public affairs information to our members of management through management bulletins, to our employees through their newspapers, to our dealers through our regular dealer publications, and an exchange of information with other business firms.

We are now instituting training programs in practical politics. We are beginning with a presentation of our Civic and Governmental Affairs organizational structure and approved plans at meetings with our management throughout the country. Then we will conduct in-plant training courses in practical politics. The in-plant courses will be conducted initially on an experimental basis. As the program develops, we will determine whether or not the preparation of booklets and training materials on practical politics for wider distribution is justified.

We have already broadened bi-partisan discussion of public issues and governmental and political affairs, both in employee publications and in management bulletins. In these discussions we make no mention of opposition to candidates or approval of them.

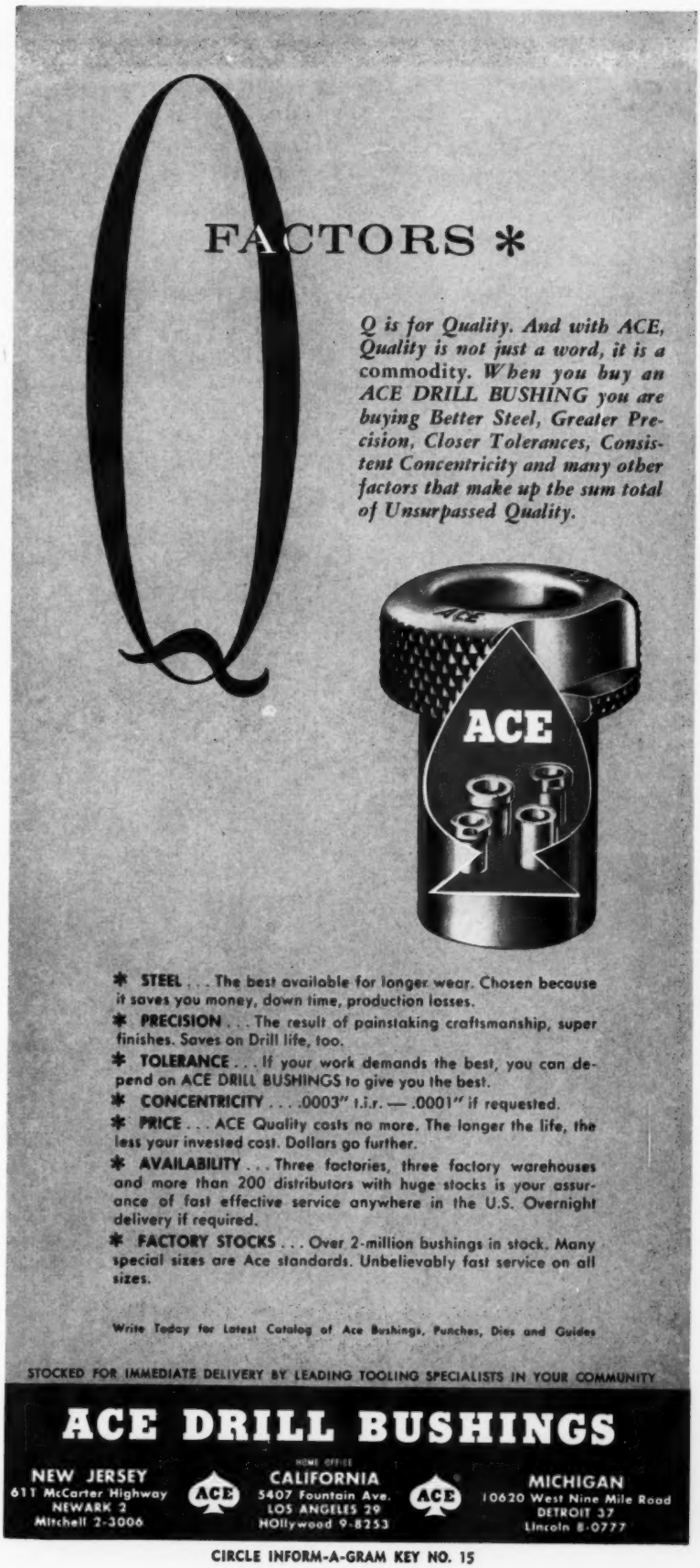
We are continuing to keep track of the voting records of members of Congress, and we will extend this service to include members of state legislatures as our regional offices get into action.

Since training is pointless unless it is put into practice, we will intensify on a nationwide basis our recruiting of employee volunteers to work in the party of their choice in their home neighborhoods.

Make Politics Convenient

Another step in our efforts to restore politics to its rightful owners is to make political and governmental activity convenient for people. I have already mentioned

... Continued on page 18


Q
FACTORS *
Q is for Quality. And with ACE, Quality is not just a word, it is a commodity. When you buy an ACE DRILL BUSHING you are buying Better Steel, Greater Precision, Closer Tolerances, Consistent Concentricity and many other factors that make up the sum total of Unsurpassed Quality.
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* STEEL . . . The best available for longer wear. Chosen because it saves you money, down time, production losses.
* PRECISION . . . The result of painstaking craftsmanship, super finishes. Saves on Drill life, too.
* TOLERANCE . . . If your work demands the best, you can depend on ACE DRILL BUSHINGS to give you the best.
* CONCENTRICITY . . . .0003" t.i.r. — .0001" if requested.
* PRICE . . . ACE Quality costs no more. The longer the life, the less your invested cost. Dollars go further.
* AVAILABILITY . . . Three factories, three factory warehouses and more than 200 distributors with huge stocks is your assurance of fast effective service anywhere in the U.S. Overnight delivery if required.
* FACTORY STOCKS . . . Over 2-million bushings in stock. Many special sizes are Ace standards. Unbelievably fast service on all sizes.
Write Today for Latest Catalog of Ace Bushings, Punches, Dies and Guides
STOCKED FOR IMMEDIATE DELIVERY BY LEADING TOOLING SPECIALISTS IN YOUR COMMUNITY
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ACE
MICHIGAN
10620 West Nine Mile Road
DETROIT 37
Lincoln 8-0777

CIRCLE INFORM-A-GRAM KEY NO. 15

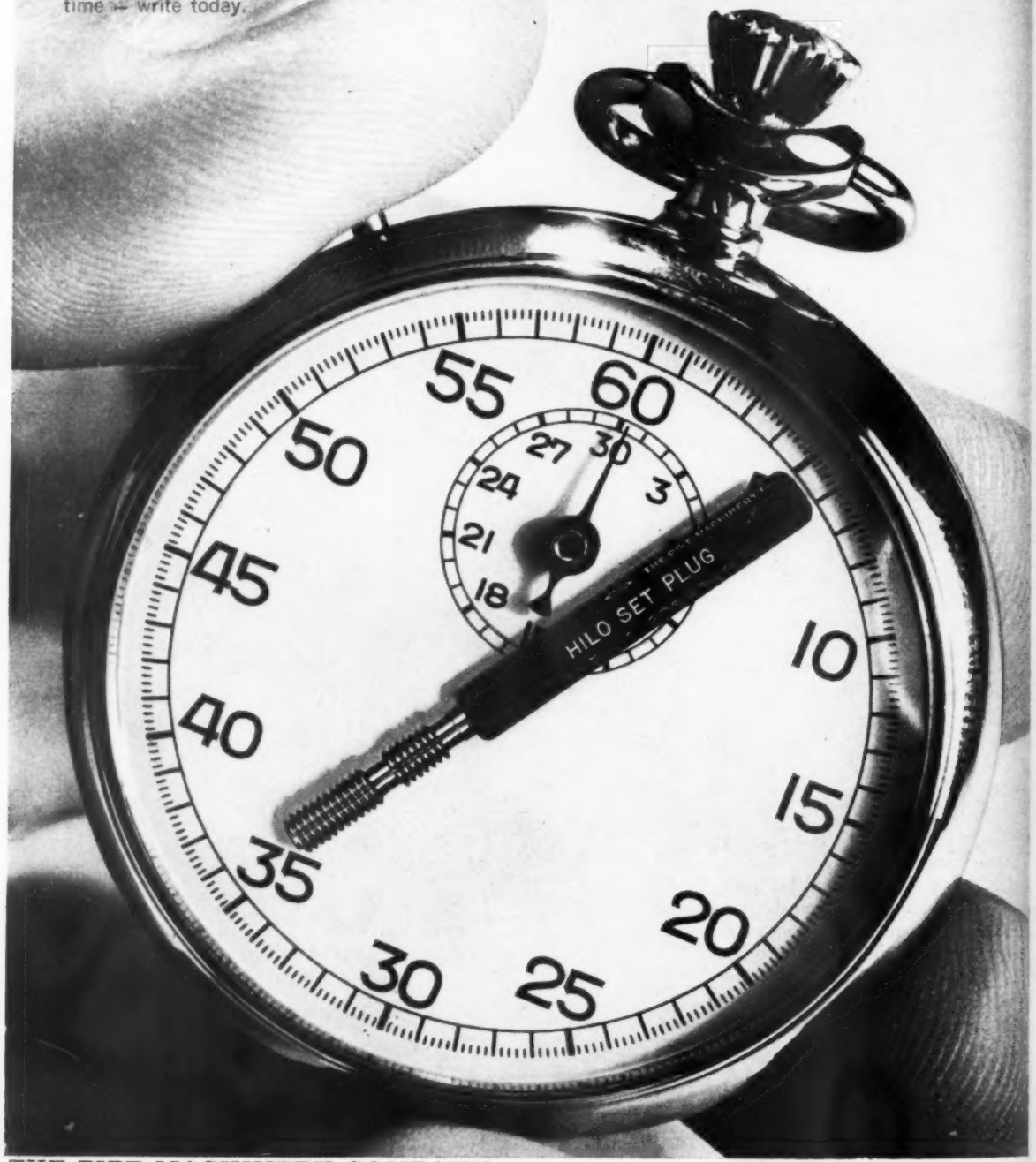
IN ONLY SECONDS YOU'RE SET WITH PIPE MACHINERY HILO PLUG GAGES

Here at last is a faster, more dependable method for setting ring gages and other adjustable instruments for the inspection of male threaded parts.

When set to the front portion, if the back portion stays out, the ring is in size. It's just that quick, just that certain!

In employing standard setting plugs, chances are it takes your operator unnecessary time to set a ring gage by the feel and shake method. With a new Hilo it takes only seconds and resetting is kept to a minimum.

For more complete information on how Pipe Machinery Hilo Set Plugs can save costly inspection time — write today.



THE PIPE MACHINERY COMPANY. 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

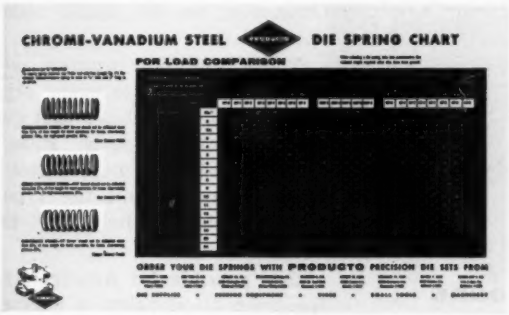
CIRCLE INFORM-A-GRAM KEY NO. 16

DIE SET DATA

available from PRODUCTO

Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*

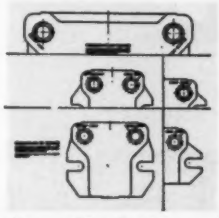

CHROME-VANADIUM STEEL
DIE SPRING CHART
FOR LOAD COMPARISON
ORDER YOUR DIE SPRINGS WITH PRODUCTO PRECISION DIE SETS FROM

Die Spring Comparison Chart

Die spring selection is simplified by this 12" x 20" chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*

Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*

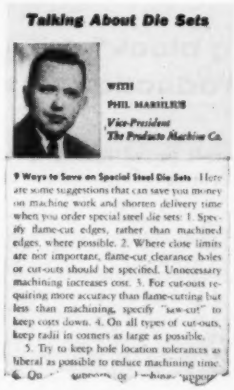


Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.

Die Set Specification Stamp

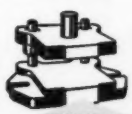
Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

***WRITE TODAY** for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.



THE PRODUCTO MACHINE COMPANY
945 Housatonic Avenue, Bridgeport 1, Connecticut

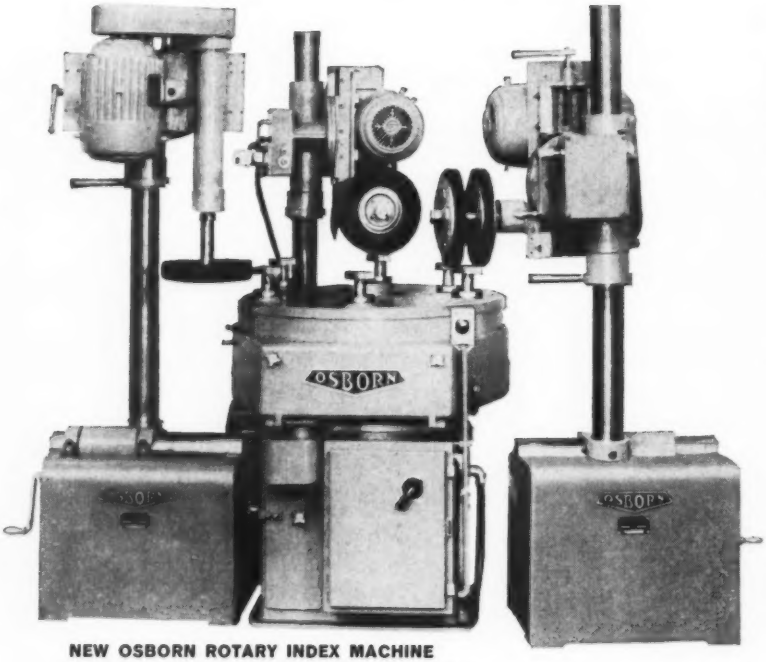
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

To cut your metal finishing costs . . .

NEW—
OSBORN
ROTARY
INDEX MACHINE



NEW OSBORN ROTARY INDEX MACHINE
Units can range from manual to fully automatic operation

Unique "building block" design means unlimited production flexibility

NEWEST ADDITION to Osborn's broad line of metal finishing machines are these Rotary Index units. Capability: significant increase of your production capacity.

Most important feature—production men can economically "build" *custom* metal finishing machines from *basic "building block"* components . . . finishing heads, index tables and electric controls. Other advanced design and construction features make these new Osborn Metal Finishing Machine units worth your immediate investigation.

Your Osborn field specialist has latest application data on a wide range of cost-saving finishing methods. And an Osborn Analysis—made in your plant—is the first step to pinpoint savings on *your* operations. Write for details. *The Osborn Manufacturing Company, Dept. L-2, Cleveland 14, Ohio.*

THE OSBORN MANUFACTURING COMPANY

METAL FINISHING MACHINES . . . AND FINISHING METHODS
POWER, PAINT AND MAINTENANCE BRUSHES
FOUNDRY PRODUCTION MACHINERY

OSBORN®

CIRCLE INFORM-A-GRAM KEY NO. 18

. . . **Month's Talk from page 15**

recruiting volunteers. A corporation can do more than this.

It is not the purpose of political training programs to develop candidates for public office. However, as political activity increases under encouragement, it is very likely that many employees will seek office and will become elected officials. Hundreds of our employees have already done so.

* * * * * * *

In carrying out the program I have just described we are very much aware that the mounting business activity in political and governmental affairs will be worthwhile and effective only to the extent that it merits public respect. This we intend to earn by the manner in which we conduct the program.

We are not adopting this program in order to tell employees what to think . . . . We are making it plain to everyone associated with our company that respect for individual freedom of decision is a cornerstone of our program. Otherwise, we are simply wasting our time.

There is no one program which would be suitable to every organization, but we believe that every organization has some stake in politics, and each must decide for itself its needs and the type of actions to take to help meet those needs.

It is possible for American businessmen to develop a course of **practical, positive** political action. There is nothing mysterious about it. But its results already are predictable. It will widen the base of political participation and give many now-quiet people a louder voice in their government.

Deaths

John C. Pangborn, 75, co-founder of Pangborn Corp., died at his home in Hagerstown, Md., Dec. 24.

John Verson, co-founder of Verson Allsteel Press Co., died Jan. 8 at Miami Beach, Fla.

Austin C. Ross, 66, formerly vice president of Worthington Corp., died Jan. 8 at Buffalo General Hospital, after a long illness.

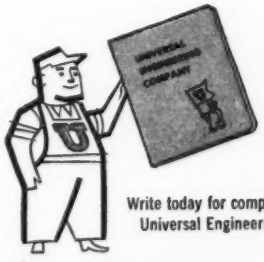
UNIVERSAL R & R DEBURRING TOOLS

with spring-loaded retractable blade give precision-cut edge or chamfer at high speed without chatter

Adjustable spring tension allows continuous contact with work-piece to eliminate chatter at high operating speeds. Free-floating blade permits self-alignment and uniform stock removal. Made in a full range of sizes to 1½" diameter.

Blades of the Universal R & R Deburring Tool are made of high speed steel, precision hardened and ground to close tolerances for interchangeability. May be used as horizontal deburrer in portable electric drill or in standard drill press.

For full information, write to Universal Engineering Company.



Write today for complete catalog of Universal Engineering products.

216

UNIVERSAL ENGINEERING COMPANY • FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 19

DoALL ECONOMY SPECIAL

VANADIUM HIGH-SPEED STEEL TAPERED END MILLS

Now you can buy end mills of this premium material to cut your machining costs—and still pay the same or less than for similar tools of conventional M-2 steel.

DoALL vanadium H.S.S. tapered end mills allow you to machine all conventional as well as hard, abrasive materials, Rc 30-40 and the newer, tough-to-cut, high-strength, high-heat-resistant metals. That's because these end mills have a higher red-heat hardness and substantially more resistance to abrasion. Their specially designed cutting face and taper give maximum cutting efficiency and make them ideal for use on extrusion dies, die-cast molds and similar work.

Try these DoALL vanadium H.S.S. tapered end mills for increased tool life at lower prices. Now available in a complete range of sizes and tapers—½, 1, 1½, 2, 3, 5, 7 and 10 deg. taper per side. Tips 3/32 in. through ⅜ in.

The Only End Mills with These 10 Important Features

- Vanadium High-Speed Steel
- Triple Draw
- Three Flute
- Double Back-Off
- Constant Spiral
- Hy-Helix
- End Cutting Teeth
- Higher Red-Heat Hardness
- More Abrasion Resistance
- Longer Life, Lower Cost

Call your local DoALL Sales-Service Store for prices.

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AT YOUR LOCAL DoALL STORE

all laboratory-inspected

THE DoALL COMPANY • DES PLAINES, ILLINOIS

Kearney & Trecker builds production machine tools for every industry*

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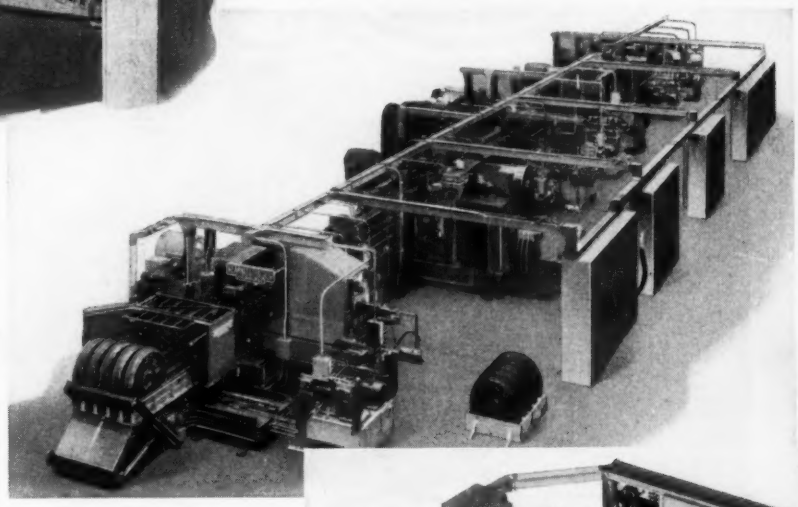
For Over 60 Years, Kearney & Trecker engineers have helped solve production problems of metal-working industries. Whatever your product or problem, Kearney & Trecker Custom Engineering Service can help you find cost-reducing solutions. Backing up this outstanding service is one of the most up-to-date plants in the world devoted exclusively to manufacturing modern production machine tools.

For the Whole Story

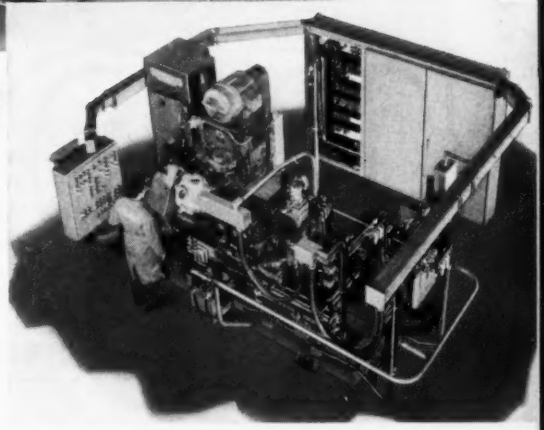
. . . ask your local Kearney & Trecker representative for Bulletin SMD-57 . . . 16 pages packed with *"Performance-Proved"* examples of how K & T Custom Engineering has paid off for manufacturers in every industry.

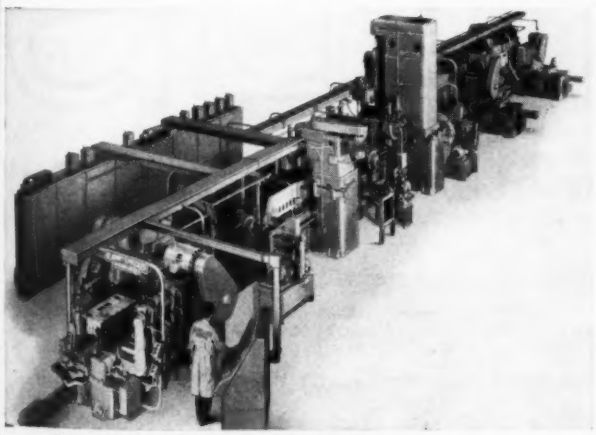
*** STEAM TURBINE INDUSTRY**
3 station rotary index machine mills root ends on large turbine buckets.



RAILWAY EQUIPMENT INDUSTRY *
30 station railroad car wheel boring, facing, and turning machine.

AIR CONDITIONING INDUSTRY *
Mills cylinder pads and feet on a variety of compressor housings.





*** DIESEL ENGINE INDUSTRY**
15 stations — 31 milling, drilling, reaming operations on 6, 8, 12-cylinder, V-type engine blocks.

KEARNEY & TRECKER MILWAUKEE ®

Special Machinery Division

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CIRCLE INFORM-A-GRAM KEY NO. 21

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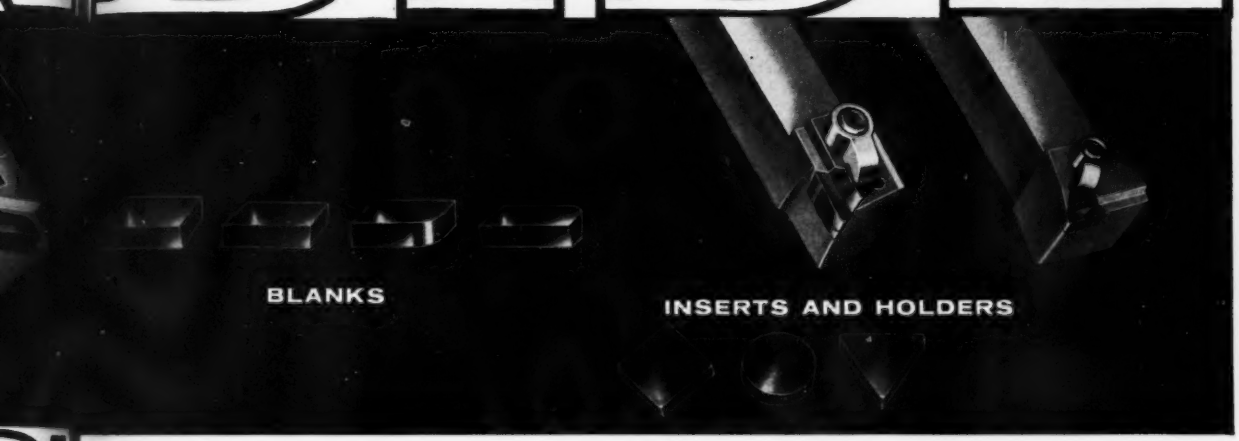
BESLY CARBIDE TOOLS

using Kennametal material exclusively!

A full line of Besly carbide tools with Kennametal material is stocked for immediate delivery through distributors, serviced by factory branches in Chicago • Cleveland • Detroit • Los Angeles

RBIDE



You've never had better carbide tool news than this . . . that your local Besly stocking distributor can now supply Besly Carbide Tools with Kennametal material, the prestige brand of carbide. Besly-Welles Corporation is headquarters for a full line of carbide single-point tools, blanks, indexable inserts and holders using Kennametal.

For full information on Besly Carbide Tools, and the name of your local Besly distributor, write today for this comprehensive catalog and price list of Besly Carbide Tools using Kennametal material.

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Tool Bits • Gages • Carbide Tipped Tools, Blanks, Inserts and Holders

CIRCLE INFORM-A-GRAM KEY NO. 23

YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON / HOLDERS

FOR END MILLS

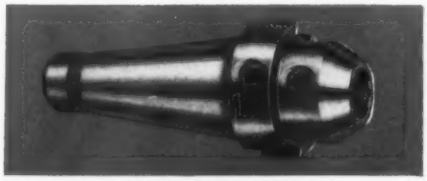
Regardless of the type or size of Straight Shank End Mills used the best results are obtained by the use of Weldon End Mill Holders and Adapters. They are manufactured of finest quality material to a high degree of accuracy to assure concentricity of the cutting tool together with maximum holding qualities.

Holders carried as stock items to serve end mill shank diameters 3/16" to 2" inclusive.

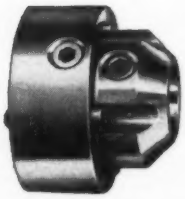
Weldon holders are used on all makes and types of milling machines and boring mills having National Standard Non-Sticking Tapers or the Brown & Sharpe or Morse type of tapers.

NATIONAL STANDARD TAPERS

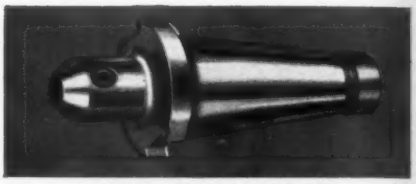
QUICK CHANGE ADAPTER AND HOLDERS



2-SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS

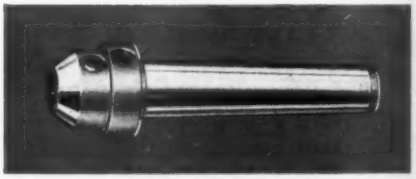


HOLDER WHICH DIRECTLY BOLTS ON STANDARD MILLING MACHINE SPINDLE. DRIVEN BY KEYS ON SPINDLE NOSE



SINGLE SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS

SINGLE SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS



2-SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS

Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 24

This is another in a series featuring the views of owners of leading contract tool and die companies

"NO TASK seems too difficult for this remarkable new Moore No.3 Jig Borer"

...writes A. A. Zeise
of Tool Products Company, Minneapolis, Minnesota

"Our ability to offer the finest work on the best equipment has consistently rewarded us with gratifying success and steady growth during the past 13 years. With Moore equipment we have always been able to assure highest accuracy and top quality in our day-to-day toolroom work.

"And now, with the recent addition of our Moore No. 3 Jig Borer, we are hitting a new high in precision—constantly achieving tolerances of .000050 (50 millionths). Located in our temperature controlled room, no task seems too difficult for this remarkable Moore machine."

You, too, will easily break the "tenth" barrier—boring, drilling, reaming and spotting holes in dies, jigs, and production parts—with the new Moore No. 3 Jig Borer.

It offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...and a speed range of 60 to 2250 RPM.

Write for illustrated brochure. Ask also for information on the new No. 3 Jig Grinder, which locates and grinds holes to less than a "tenth."

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Avenue, Bridgeport 7, Connecticut

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

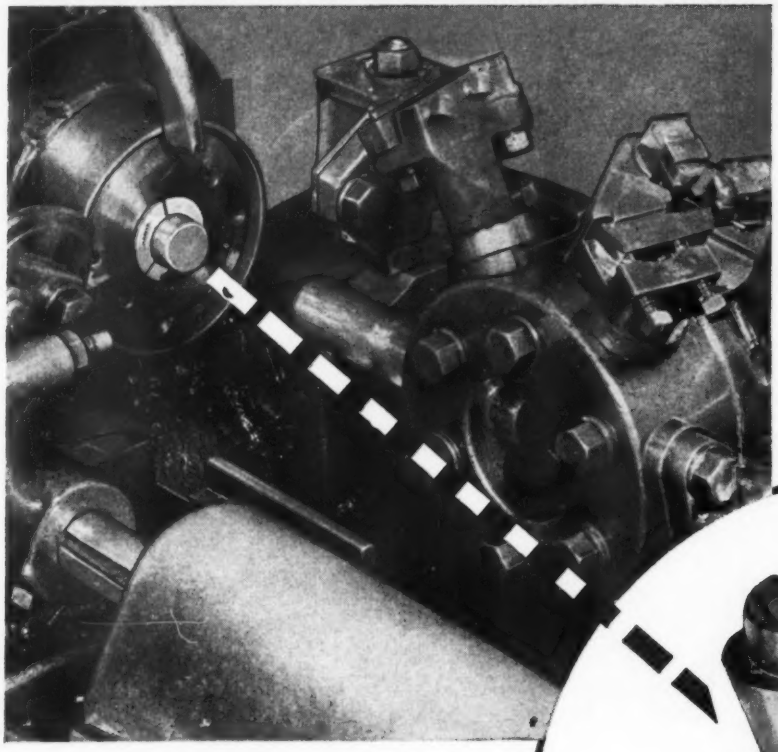
ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 25

HARDINGE
ELMIRA, N.Y.

PRECISION PRODUCTS
for BROWN & SHARPE machines



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Elmira, Boston, Atlanta,
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Rochester, N. Y., Dayton, Detroit,
Minneapolis, Chicago, St. Louis, Portland,
Seattle, Oakland, Los Angeles, Toronto.

Order From **HARDINGE** Today

One Source of Supply Means Purchasing Economy

Write for FREE Bulletin B&S

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 26

AT BOOTH 427 ASTE SHOW, April 21-28 • DETROIT

Microbore® adjustable tooling! with Kendex® throw-away inserts!

Clamp-On Type
Available in sizes 10, 15, 20.

Screw-On Type. Available in sizes 3, 5, 7, 10.

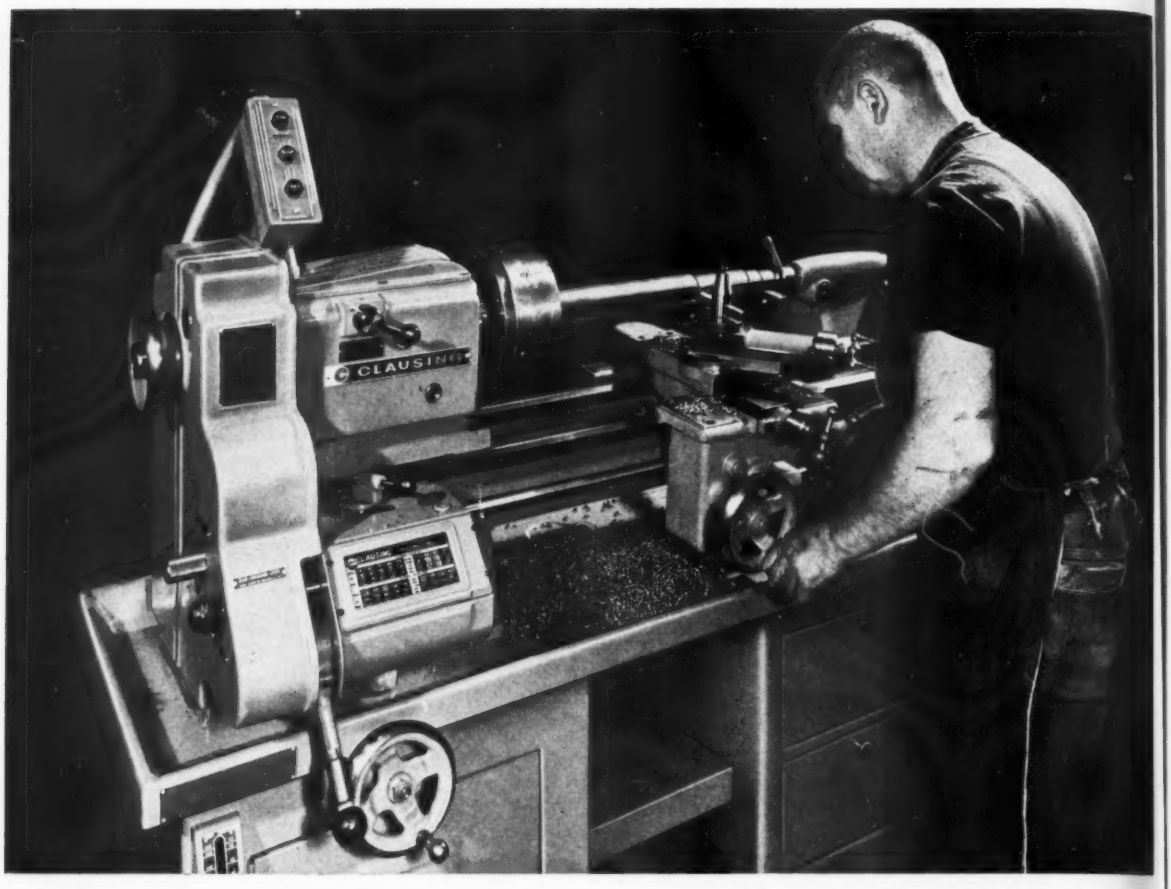
Accuracy! Economy! You get the best of both. Microbore, the single point cutting tool with Micrometer vernier adjustment becomes the tool holder—rigid, adjustable to precise accuracies in seconds. Kendex mechanically held throw-away inserts do the cutting. Triangular shaped, the inserts can be indexed from tip to tip. When expended, the insert is thrown away. Replacement is simple, costs far less than re-grinding. Inserts are held in place by *screw-on button* or *clamp* for fast indexing or removal.
Available in sizes 3, 5, 7, 10, 15 and 20. Write for complete information on Microbore tooling with Kendex throw-away inserts, the latest development in Microbore—the complete tooling system.

DeVlieg® Microbore® System

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street • Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 27



Now . . . crown-shaved gears standard equipment on Clausing 12¾" lathes!

All gears on Clausing lathes are crown-shaved for quieter, smoother operation and greater accuracy than ever before. It's another PLUS feature that makes Clausing truly outstanding among lathes in its class. Here are a few of the many more—

(1) Flame-hardened bed ways standard equipment at no extra cost.

(2) Heavier throughout—"have more guts than most of our machines costing 3 or 4 times as much."

(3) Forged steel spindle, with L-00 or 2¼"-8 threaded nose.

(4) "Zero Precision" Timken tapered roller bearings.

(5) Choice of heavy-duty variable speed or 10-speed countershaft, with clutch and brake optional.

(6) Verified precision—factory test report accompanies each lathe.

The result . . . this user report is typical of the performance and value you get in Clausing lathes: "After investigating the lathe field very thoroughly our choice was Clausing, and subsequent performance exceeded our expectations. We recommend the Clausing 6300 series lathes as the competition-beating answer in their capacity range." (signed) K & W Machine Works, Springfield, Mass.

See Clausing . . . check, feature for feature, dollar for dollar . . . before you buy any lathe of comparable size. See for yourself why Clausing is acclaimed the outstanding lathe value.

Write FOR ILLUSTRATED CATALOG TODAY

CLAUSING **CLAUSING DIVISION**
ATLAS PRESS COMPANY
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CIRCLE INFORM-A-GRAM KEY NO. 28

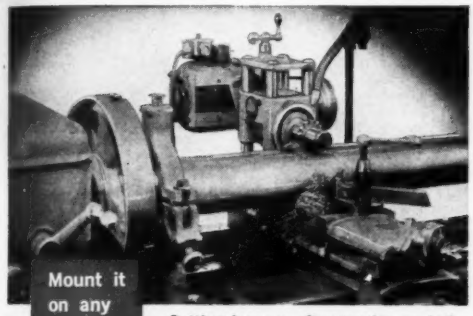
get portable, precision machining anywhere

AT LOWER COST

WITH DUMORE VERSA-MIL®

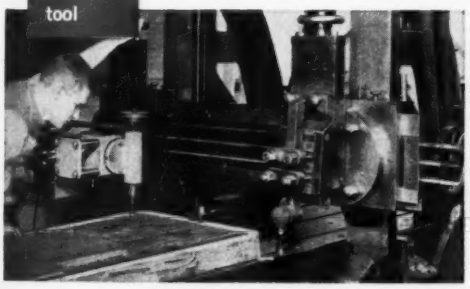
only $625, No. 2 Unit, FOB Racine

MILLS • BORES • SHAPES
SLOTS • GRINDS • DRILLS

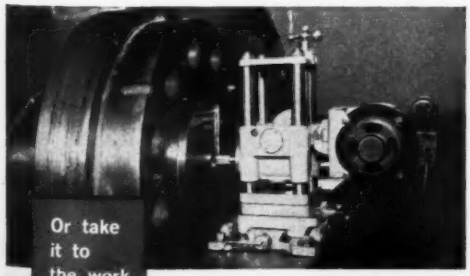


Mount it on any machine tool

Cutting keyway after turning on lathe



Drilling after shaping casting on shaper



Or take it to the work

Milling Huge steel forging in place

Compact, rigid, portable. Performs in any position. Built-in power and feeds. Use independently or attach to machine tools for secondary operations. Saves handling, moving, set-up and down-time. Also used for machining in-place parts too big for standard machines. Provides close tolerance quality at *profitable* metal removal rates. Gives you the *advantage* of machining where it is most economical!

Ask your local DUMORE Industrial Supply Distributor

for a demonstration . . . at his place or in your shop. Ask him, too, about the many accessories for broader, lower cost machining operations in maintenance, job shop, tool room or production applications. One unit often pays for itself on one job!

You Can Do More with DUMORE

All-Purpose Precision Metalworking Tools

THE DUMORE COMPANY • 1304 Seventeenth St., Racine, Wisc.

Versa Mil • Drill-N-Tap Units • Drilling Units • Drill Heads
Micro-Drills • Drill Grinders • Precision Grinders
Hand Grinders • Flex-Shaft Tools • Quills and Accessories

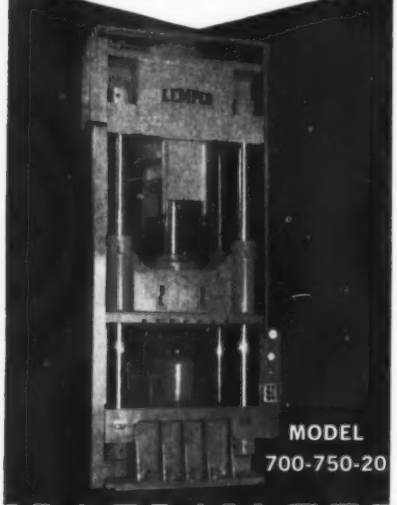
SEE IT WORKING AT THE ASTE SHOW, DETROIT

BOOTH 2249

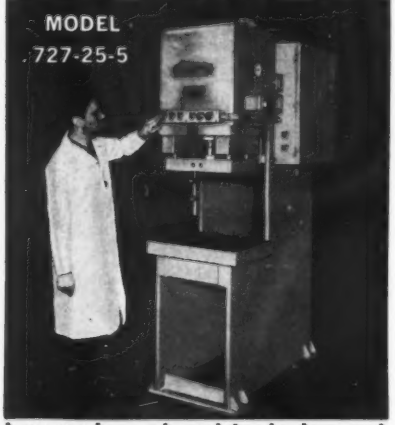
CIRCLE INFORM-A-GRAM KEY NO. 29

PRESS BRAKES
SHOP PRESSES
DIE TRY-OUT
MOLDING PRESSES
GAP FRAME TRIMMING
STRAIGHTSIDE • TIE ROD
STRAIGHTENING

PUZZLED ABOUT PRESSES?



SEE LEMPCO



Lempco is equipped to design and build hydraulic presses to your exact requirements.

LEMPCO INDUSTRIAL, INC.
MACHINE & TOOL DIV
DUNHAM RD., BEDFORD, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 30

MANUFACTURING MEMOS

Industry List . . . About 95% of the metalworking industry's sales and employment of 8-million people—more than half of all the people in the U. S. engaged in manufacturing—represent 31,000 plants in the metal producing industry. This is just one of the statistics you'll find in the new Dun & Bradstreet Metalworking Directory. The 2,855 directory is divided into three sections—plants are listed geographically, aphabetically, by product line, and by county and state. For details, contact Dun & Bradstreet, Inc., 99 Church St., New York 8.

New Groups . . . Anyone with a real interest in powder metallurgy can now belong to The American Powder Metallurgy Institute. Previously restricted to corporate membership, the group has opened its doors "because of the growing interest of others not directly connected with the field." Get the scoop in a brochure from APMI, 60 E. 42nd St., New York 17.

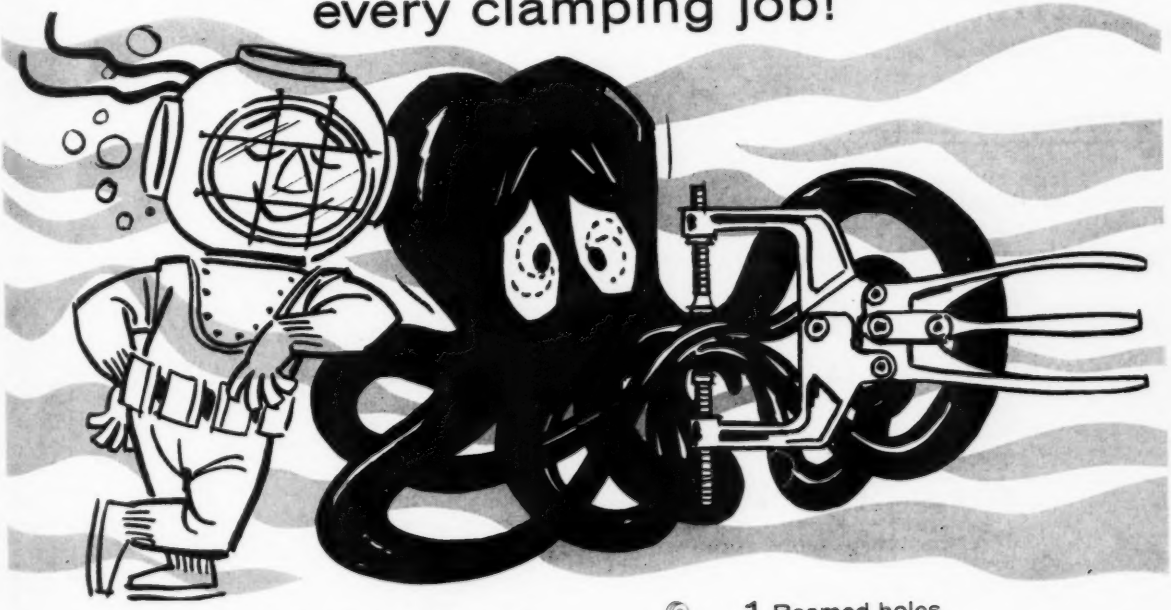
Apprentice Advisor . . . John D. Dewhurst, president of Arrow Tool Co. and secretary of the National Tool & Die Manufacturers Association, recently began his two year term on the Federal Committee on Apprenticeship—an advisory body to the Bureau of Apprenticeship and Training of the Department of Labor.

New Stainless . . . A new grade of straight chromium stainless steel strip provides better workability in stretch bending and deep drawing. A small alloy addition and application of newly developed processing techniques have made Uniloy 435 an improvement over Type 430.

Another "Million" . . . Latrobe Steel Co. recently hit another "millionth milestone." They produced their 300-millionth pound of desegatized tool and die steel, which climaxes 14 years of continuous production of these specialized steels.

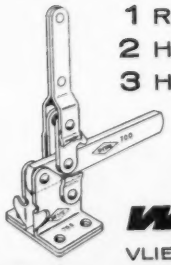
Tool Clinic . . . Buckeye Tools Corp. is attempting to improve customer-factory communications by putting in the field "a clinic on wheels." Basically the clinic's job is to provide the right tool for the right job. It also brings customers and the salesmen up-to-date on new products, gives service tips on older products, advises on special applications, and relays suggestions back to home base.

There's a WESPO clamp or plier for every clamping job!



80 models and sizes...

made better three ways to give more positive holding, last longer!

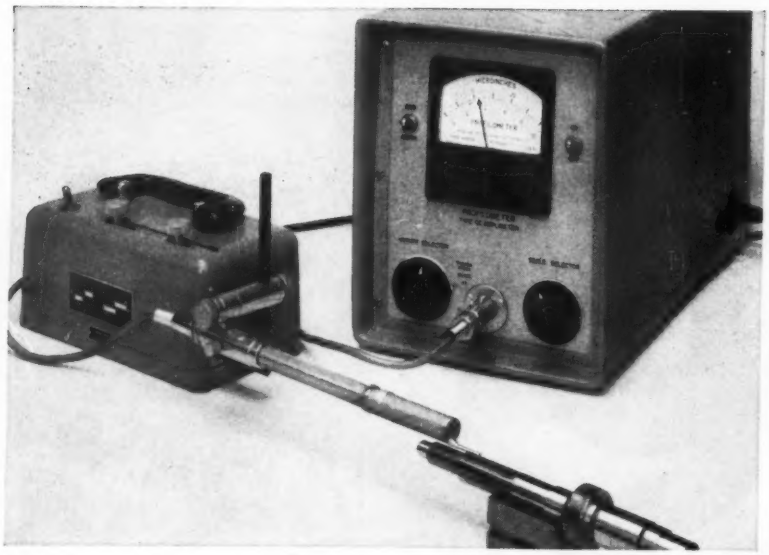


1 Reamed holes
2 Hardened serrated bushings
3 High tensile strength rivets

send for free catalogs describing Wespo clamps and fixture details

WESPO DIVISION
VLIER ENGINEERING CORPORATION
Formerly West Point Manufacturing Company
26935 W. Seven Mile Road • Detroit 19, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 31



PERTINENT QUESTION:

WHEN do you need the Profilometer®?

FACTUAL ANSWER:

Whenever you must precisely *know* the roughness of *any* production surface — quickly, dependably, in microinches (arithmetical or rms).

FREE BULLETIN LT14 gives details — describes cost-saving applications. May we send you a copy?

MICROMETRICAL MMC MANUFACTURING COMPANY
345 S. MAIN ST. ANN ARBOR 6, MICHIGAN

Manufacturer of the PROFILOMETER®, PROFICORDER®, MICROCORDER®, WAVOMETER®, ANDEROMETER®, VAROMETER®, CHART VIEWER • Exclusive American Sales Agent for CENSOR Dimensional Gaging and Sorting Equipment

CIRCLE INFORM-A-GRAM KEY NO. 32

MANUFACTURING MEMOS

New Name

Because the name Birdsboro Steel Foundry & Machine Co. no longer describes the product line, the company changed it to Birdsboro Corp.

Changing Times

The Warner & Swasey Co. has acquired a substantial interest in Wang Laboratories, Inc., electrical and electronic device and component manufacturer.

Eaton Mfg. Co. announced recently that its wholly owned subsidiary, The Cleveland Worm & Gear Co., and the latter's subsidiary, The Farval Corp., are now divisions of Eaton.

Wheelabrator Corp. recently made Lord Chemical Corp. a majority-owned subsidiary.

Apex Machine & Tool Co. is now a wholly-owned subsidiary of Gardner Denver.

Representatives

R. C. Dudek & Co. was recently appointed Waltham Precision Instrument Co.'s representative for California and Arizona.

The Atrax Co. is now represented by Tri-Seco, Inc., in the greater New York and Long Island area, and Engineered Sales Co. in northern New Jersey territory.

Motch & Merryweather Machinery Co. is now serving Oliver Instrument Co. in the Michigan and northwestern Ohio area.

Coming Events

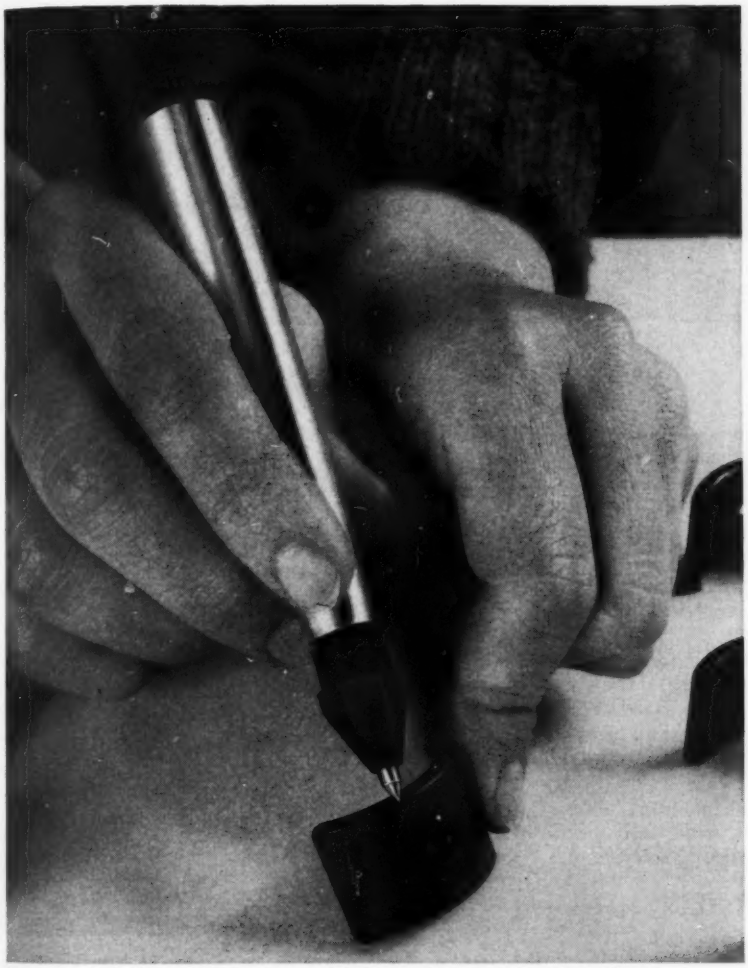
March 6-9. American Society of Mechanical Engineers' Gas Turbine Power & Hydraulic Conference, Rice Hotel, Houston, Texas.

March 7-8. Steel Founders' Society of America's 58th Annual Meeting, Drake Hotel, Chicago.

March 9-11. Instrument Society of America's Temperature Measurement Symposium, Deshler Hilton Hotel, Columbus, Ohio.

NEW the fastest and easiest method of marking...

THE ROTOR Airiter



Even on narrow edges or small parts... the Airiter makes its mark... fast and easy.

Rotor Tool announces a vastly improved method for marking all types of materials, such as metal, plastic, ceramic or glass. The new Rotor Model AR Airiter with its rapid-fire, short-stroke action and sharp stylus sets a new standard for versatile, easy, speedy marking of parts and tools.

No messy chemicals or risky heat are used. The Airiter has a simple reciprocating air motor, operates on a supply of 40 to 100 psi air pressure, up to 12,000 blows per minute. Its speed and depth of mark are controlled by the throttle *on the tool* and are infinitely variable to suit the job.

It will not stall while writing. No pressure regulator is needed. It's comfortable, no reaction to operator—as easy to write with as a pencil. It weighs only 5¼ ounces with hose, is only 5 5/16" long, has only three moving parts. Very low maintenance, precision-built to last. Its carbide stylus is readily sharpened or replaced. *And it is priced at only $49.50 plus postage.*

Try it in your shop and see how it writes circles around other methods! Send us your purchase order. Money refunded if, after a five-day trial, the tool is unsatisfactory. *The Rotor Tool Company, 26312 Lakeland Boulevard, Cleveland 32, Ohio.*

Only $49.50
plus postage

Here's the RIGHT TOOL for YOUR job!

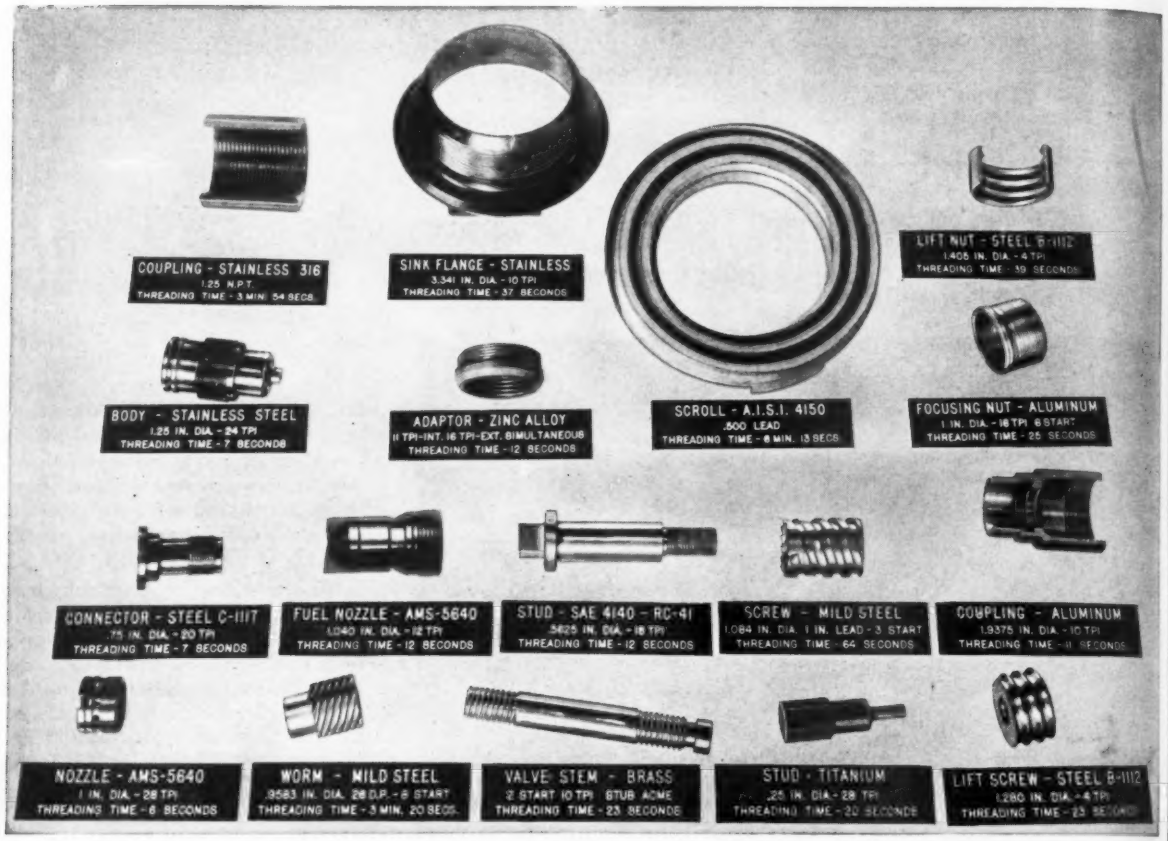
ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers Special Tools • Air Motors

ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders

ROTOR TOOLS®
The Rotor Tool Company · Cleveland, Ohio
SUBSIDIARY OF THE COOPER BESSEMER CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 33

Start saving money right now on threading jobs like these with...


COUPLING - STAINLESS 316
1.25 N.P.T.
THREADING TIME - 3 MIN. 54 SECS.
SINK FLANGE - STAINLESS
3.341 IN. DIA. - 10 TPI
THREADING TIME - 37 SECONDS
LIFT NUT - STEEL B-1112
1.406 IN. DIA. - 4 TPI
THREADING TIME - 39 SECONDS
BODY - STAINLESS STEEL
1.25 IN. DIA. - 24 TPI
THREADING TIME - 7 SECONDS
ADAPTOR - ZINC ALLOY
11 TPI-INT. 16 TPI-EXT. SIMULTANEOUS
THREADING TIME - 12 SECONDS
SCROLL - A.I.S.I. 4150
.500 LEAD
THREADING TIME - 6 MIN. 13 SECS.
FOCUSING NUT - ALUMINUM
1 IN. DIA. - 16 TPI 6 START
THREADING TIME - 25 SECONDS
CONNECTOR - STEEL C-1117
.75 IN. DIA. - 20 TPI
THREADING TIME - 7 SECONDS
FUEL NOZZLE - AMS-5640
1.040 IN. DIA. - 12 TPI
THREADING TIME - 12 SECONDS
STUD - SAE 4140 - RC-41
.5625 IN. DIA. - 18 TPI
THREADING TIME - 12 SECONDS
SCREW - MILD STEEL
1.084 IN. DIA. 1 IN. LEAD - 3 START
THREADING TIME - 64 SECONDS
COUPLING - ALUMINUM
1.9375 IN. DIA. - 10 TPI
THREADING TIME - 11 SECONDS
NOZZLE - AMS-5640
1 IN. DIA. - 28 TPI
THREADING TIME - 6 SECONDS
WORM - MILD STEEL
.9583 IN. DIA. 28 D.P. - 6 START
THREADING TIME - 3 MIN. 20 SECS.
VALVE STEM - BRASS
2 START 10 TPI STUB ACME
THREADING TIME - 23 SECONDS
STUD - TITANIUM
.25 IN. DIA. - 28 TPI
THREADING TIME - 20 SECONDS
LIFT SCREW - STEEL B-1112
1.280 IN. DIA. - 4 TPI
THREADING TIME - 23 SECONDS

CRI-DAN SINGLE-POINT THREADING LATHES

...cut costs with simple single-point carbide tools. They're easily resharpened or replaced. They eliminate expensive upkeep of thread milling cutters or thread grinding wheels.

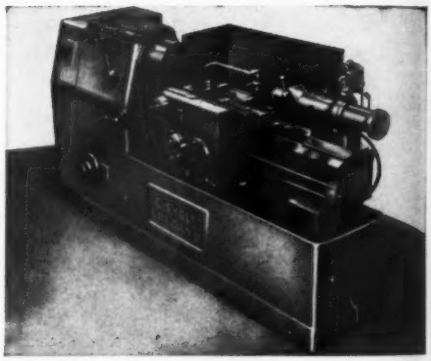
...assure extremely accurate lead and thread form and exceptional finish with low-cost carbide tools on materials that don't allow economical threading by other methods.

...handle any material from titanium or toughest alloy steels to brass and other non-ferrous metals with a wide selection of spindle speeds and feeds to meet all job requirements.

...set up fast to produce single- or multiple-start, coarse or fine, left- or right-hand threads, parallel or tapered with metric or inch pitches—thread up to shoulders on all types of internal and external operations.

...cut costs from start to finish with CRI-DAN's speed, versatility and economy.

Why put off the savings the CRI-DAN method can bring you *right now*? Ask your Gisholt Representative for complete details. Or write us for literature or cost estimates on your particular work.



Two models are available. The smaller Model B (shown) offers extreme flexibility with spindle speeds of from 154 to 2808 r.p.m.; 3" capacity between centers and 15½" swing over bed. Rugged saddle supports fast-acting threading slide, easily positioned along bed. Complete change-over from job to job can be made in 15 minutes.

Investigate Gisholt's Extended Payment and Leasing Plans

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS THREADING LATHES • Factory-Rebuilt Machines with New-Machine Guarantee

CIRCLE INFORM-A-GRAM KEY NO. 34

Appointments of **Wayne W. Camp** as technical representative in the midwest and east, and **Walter R. Hallis** in the East Coast area, have been made known by Ren Plastics, Inc.

Now representing S-P Mfg. Co. in the middle Atlantic states is **Thomas A. O'Reilly,** with headquarters in Philadelphia. In Connecticut and western Massachusetts, **George V. Rogers** is the S-P representative.

New sales and service engineer for Anocut Engineering Co. in north central Pennsylvania and New York is **Frank Skahan. James D. Butkus** now serves the Cincinnati area, and **Nicholas Chochron,** Chicago and St. Louis.

Wesley F. Payne has been appointed chief field engineer in the Tri-Matic Oscillating Abrasive Belt Grinder Division of Sales Service Mfg. Company.

Promotion of **Robert L. Edwards** to general sales manager for Master Pneumatic, Inc., was recently announced.

Russell O. Newton has joined Erie Foundry Co. as sales manager.

Newly appointed sales manager of the Heavy Machinery Division, The Cleveland Crane & Engineering Co., is **R. G. Birkin.**

Taking over as general sales manager of Seneca Falls Machine Co. is **Ray A. Young.**

Thomas Jameson now serves as sales and service engineer in the New England area, and **Harold J. Milliman** in Michigan, for Wesson Company.

The Torrington Co.'s new district engineers include **Richard Finn,** Tulsa, Okla.; **Harvey M. Mauel,** Eastchester, N.Y.; **Robert F. Deacon,** Pittsburgh; and **John W. Stout,** Philadelphia.

Frank E. Olson now covers sales activity in the Baltimore-Virginia area for Morse Twist Drill & Machine Company.

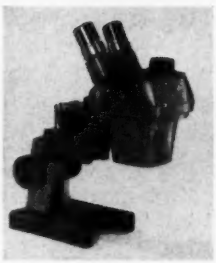
PRECISION PRODUCTION PROBLEMS?

Here's help from Bausch & Lomb in TOOL DESIGN INSPECTION FABRICATION MEASURING TESTING

TOOLMAKERS' MEASURING MICROSCOPE
Quickly measures transparent or opaque objects of any contour. Linear, accurate to 0.0001"; angular, to 1 minute of arc.

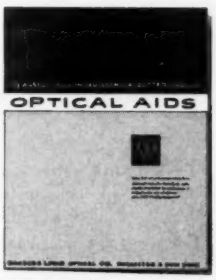
NEW UNIVERSAL STAGING FIXTURE
Positions small parts for critical measurement with B&L Bench Comparator and Toolmakers' Microscope. Auxiliary base, with 7" travel, increases range beyond that of measuring stage.

STEREOZOOM* MICROSCOPES
Magnified 3-D views of tiny parts. Dustproof, shockproof, can be mounted right in machine or fixture. Speeds assembly, inspection. Most complete line, widest field of view.



BENCH COMPARATOR
Exclusive under-stage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes, show errors instantly. Reads to 0.0001" with optional micrometer stage.

OPTICAL AIDS CATALOG
Time-and-money-saving data on Surface Comparators, Industrial Magnifiers, Macroscopes, Micrometer Discs, Brinell Microscopes, Microscope Bodies, Wide Field Tubes, Shop Microscopes.



NEW SCRATCH-DEPTH GAGE
With this simple hand-held instrument you can measure the depth of any scratch to 0.0001", with a range of 0" to 0.015"

*TRADEMARK, BAUSCH & LOMB OPTICAL CO.

MAIL COUPON TODAY FOR VALUABLE DATA

BAUSCH & LOMB OPTICAL CO.
77303 Bausch St., Rochester 2, N. Y.

Please send literature on optical production aids checked below:
☐ Toolmakers' Microscope ☐ Scratch-Depth Gage ☐ Bench Comparator ☐ Optical Aids Catalog ☐ StereoZoom* Microscopes ☐ Universal Staging Fixture.

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

BAUSCH & LOMB
SINCE B&L 1853

CIRCLE INFORM-A-GRAM KEY NO. 35

You get 4 big advantages with all 4

SINGLE FLUTE

The high positive rake and single flute construction assure burr-free holes and chatterless operation over a wider range of speeds and feeds. Suggested for pre-drilled or pre-formed holes that are too small for a 3-flute countersink.

THREE FLUTE

Especially useful in portable work, because they center more readily. Engineered to give chatter-free performance in both countersinking and deburring operations. Assure better tool life in most applications.

CLEVELAND *New Style* COUNTERSINKS

1. Easy feeding
2. Long tool life
3. Burr-free holes
4. Better finish

Many tests in customers' plants have proved that the newly designed CLEVELAND New Style Countersinks give *outstanding performance* in all materials . . . on both machine and portable equipment . . . and operate without chatter over a wider range of speeds and feeds than ever before possible.

The High Speed New Style Countersinks (Single Flute and Three Flute) are available in body diameters of ¼″ to 1½″, with included angles of 60°, 82°, 90°, 100°, 110° and 120° for sizes up to 1″, and angles of 60° and 82° for the 1½″ size.

The Carbide Tipped New Style Countersinks (Single Flute and Three Flute) come in body diameters of ¼″ to 1″, with included angles of 60° and 82°.

Write for your copy of this Helpful New Folder

Gives recommendations for countersinking holes in various materials, in both portable and machine work. Illustrates methods of regrinding. Lists the sizes and point angles of the new Countersinks.

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR
for CLEVELAND Quality Tools . . . *prompt delivery from stock*

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York • Atlanta • Cleveland • Detroit • Chicago • Dallas • Los Angeles • San Francisco

CIRCLE INFORM-A-GRAM KEY NO. 36

MEN YOU SHOULD KNOW

New director of engineering at Micromatic Hone Corp. is **John H. Greenling.** Taking over Greenling's former job as chief engineer is **Robert W. Militzer.**

Appointments of **Joseph W. Wells** to chief product engineer, and **Roland E. Brault** to chief industrial engineer, have been announced by the Wallace Barnes Division of Associated Spring Corp.

Newly appointed director of manufacturing services for Borg-Warner Corp. is **William F. Martin.**

P. O. Peterson has been elected president, chief executive officer, and a director of Hercules Motors Corporation.

Recently appointed factory manager for National Broach & Machine Co. is **Frank Kirsten. Carl Motz** was named chief engineer.

John F. Claydon, former manager of the Coated Abrasives Division of the Carborundum Co., was recently elected its vice president.

Van Norman Machine Co. announces the election of **George P. Burns** to vice president and sales manager of machine tools.

Chrysler Corp's recent promotions include **G. H. Stover,** general plants manager, and **E. W. Engel,** director of production control for the car and truck assembly group.

Position changes at DeVlieg Machine Co. include **C. B. DeVlieg,** now chairman of the board; **C. R. DeVlieg,** now president; **Richard A. Jerue,** vice president in charge of engineering; and **Allen N. Sweeney,** director of engineering and research.

Oran W. Thompson has taken over as vice president-chief engineer of W. O. Barnes Co., Inc.

Niagara Machine & Tool Works has announced the appointment of **Edwin A. Munschauer, Jr.,** as director of research, and **H. Stanton Cheyney,** service manager.

... Continued on page 38

NEW... IMPROVED... model 15A

the **STRIPPIT FABRICATOR**

for high-profit, low-cost punching, notching and nibbling... for prototype, short and medium production runs

FEATURING the new *Strippit Electro-Hydramatic Head* — simplified design . . . minimum number of parts . . . needs no pressurized air. Makes the 15A easier to install, simpler to maintain, more economical to operate.

punches
any round or shaped hole up to 3½" diameter in sheet material — up to ¼" mild steel.

notches
90° corners — rectangular, radii, vee and special shape edge notches — up to ⅛" capacity in mild steel.

nibbles
straight line or contour shearing up to 38" diameter circle, at 165 strokes per minute, ⅛" mild steel.

accurate, quick-set gauging
a unique, multiple-stop system for exact work positioning to any layout specifications — *in seconds.*

quick-change punches and dies
from one size to another in less than 20 seconds — within easy reach in labeled, built-in file drawers.

easy conversion
to a high speed production punching unit with the Strippit Duplicator and the Dupl-O-Scope or Microbars to punch Duplicator templates.

WRITE TODAY
for new Catalog 15A and demonstration at your own plant of the capabilities of this high-profit fabrication system.

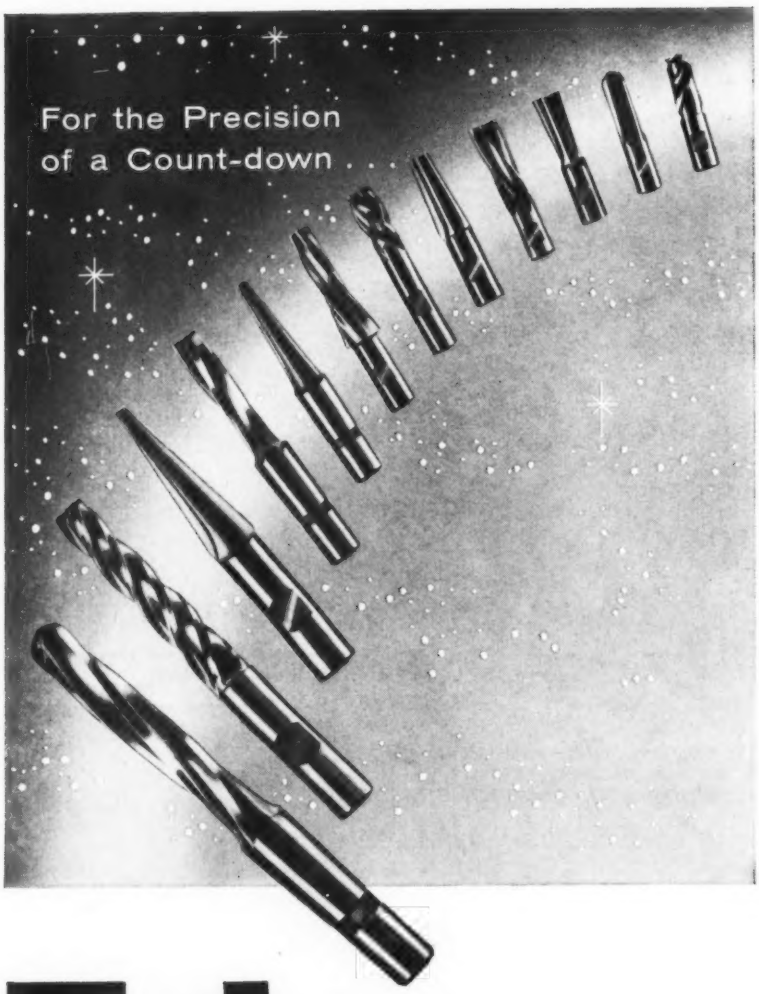
UNIT OF HOUDAILLE INDUSTRIES, INC.

WALES **STRIPPIT** INC.

212 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 37



T-J LAUNCHES A NEW
CUTTING TOOL LINE
FOR MILLING ACCURACY

For precision milling to close tolerances, so vital in today's high-speed, high-production manufacturing, T-J now offers a new, improved line of milling cutters. The new cutter line features a high helix angle, double back-off, and a right-hand spiral to produce more and smoother cuts between grinds, and a free-cutting, stronger tool.

Specially designed and precision-manufactured for die sinking and production milling, the new line is designed to include flats on the shanks for set screw type drivers on all of the end and side milling cutters. Write today for complete information to the Tomkins-Johnson Company, Jackson, Mich.

Ask for completely new cutter catalogue No. 259.

T-J TOMKINS-JOHNSON
RIVETORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

CIRCLE INFORM-A-GRAM KEY NO. 38

. . . Men from page 37

Harry A. Skillman is now the West Coast manager of the Press & Die Supply Division, and **Milton J. Jefferis,** factory manager for E. W. Bliss Co.

Newly appointed engineering manager of the Master Power Corp., a Black & Decker Mfg. Co. subsidiary, is **William S. Brucker.**

Promotions announced by Worthington Corp. include **Aloysius M. Tullo,** group vice president; **William A. Finn,** general manager of the Harrison (N.J.) Division; and **Frederick B. Seel,** general manager of the Holyoke Division.

John F. Probst succeeds **Russell E. Frushour,** who is retiring, as president of South Bend Lathe, Inc., a subsidiary of American Steel Foundries.

Yale Materials Handling Division, The Yale & Towne Mfg. Co., has announced that **Norman R. Amberg** is the new plant manager and **Thomas H. Olson,** works manager.

Erman V. Cavagnero is the new chief design engineer and **Werner Vogt** is the chief development engineer for the Machine Division of The Torrington Mfg. Corp.

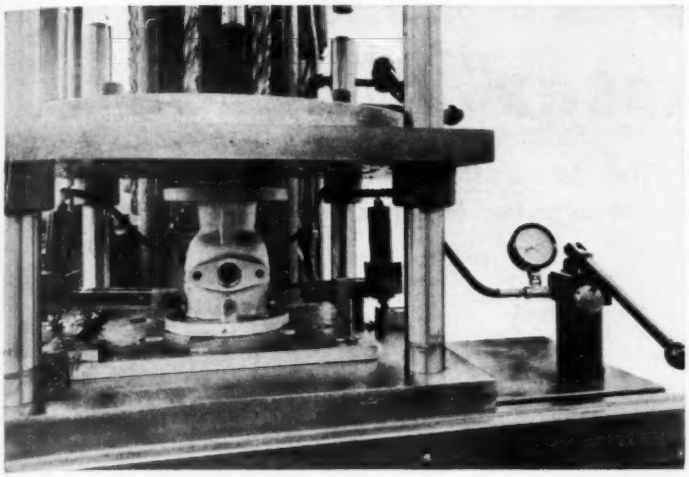
Rivett Lathe & Grinder, Inc. recently announced that **Thorwald S. Ross, Jr.,** is now vice president in charge of manufacturing; **Walter C. Woodworth,** production and procurement manager; and **William R. Wright,** purchasing agent.

Albert J. Reichers is now general plant manager at Copper Alloy Corporation.

John P. Sullivan, formerly personnel manager of Hamilton Standard, division of United Aircraft Corp., was recently elected president of Hamilton-Electrona, Inc., a new company owned by **Irving Rossi,** the Carl Zeiss Foundation of West Germany, and United Aircraft Corporation.

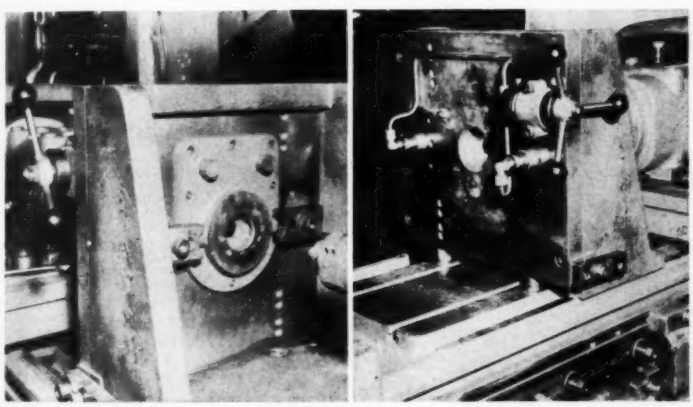
Taking over as general manager of Cone Automatic Machine Co. Inc. is **Robert R. Rhodehamel.**

What other shops found out about Hydraulic Clamping



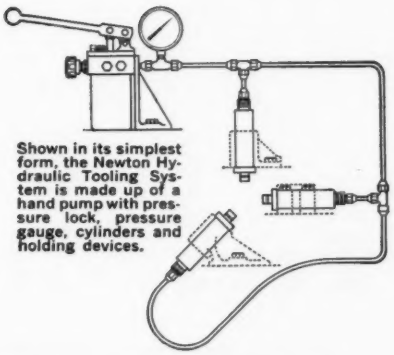
LODDING ENGINEERING SAVES MORE THAN 2½ HOURS A DAY . . . since its switch from manual to Newton Hydraulic Clamping, reports Edward Bedard, Lodding Plant Superintendent. Former manual method took 22 minutes — 14 clamps for each set-up. Newton System reduced number of clamps required to two, with one manual operation. Repositioning takes 4 minutes per set-up which, done 3 times daily, saves nearly an hour in set-ups. Another 105 minutes per day is gained in production time. Total time saved — over 2½ hours a day. Mr. Bedard also states, "We can pay for this unit every two weeks, if we include our installation time." Shown is a multiple drill fixture.

(Lodding Engineering Corporation, Auburn, Mass., is the leading manufacturer of doctors and doctor blades for the pulp and paper industry.)



KINNEY CUTS CLAMPING TIME 90% PER PIECE . . . since the application of Newton Hydraulic Tooling to the clamping parts in a precision boring operation (illustrated above). "Actual clamping time per piece decreased by 90% and floor to floor time decreased by 67%," states Melvin S. Naiman, Tool Engineer at Kinney Manufacturing Co. With the stud and nut arrangement originally used, the machine operator experienced difficulty in tightening clamping nuts with a wrench. "Complete elimination of this drawback," Mr. Naiman reports, "was the result of changeover to hydraulic cylinders. Operator's clamping motions have been reduced to a single rotation of the screw pump handle."

(Kinney Manufacturing Company, Boston, Mass., is a division of New York Air Brake Company.)



Shown in its simplest form, the Newton Hydraulic Tooling System is made up of a hand pump with pressure lock, pressure gauge, cylinders and holding devices.

Further advantages of Newton Hydraulic Clamping

Besides speeding production by reducing set-up time, the Newton System is easy, safe and economical to operate. Uniquely versatile, any number of clamping cylinders can be used up to the fluid capacity of the hand pump. A multiplicity of clamping positions can be achieved — horizontal, vertical, angular, swing, trunnion. Unexcelled for clamping odd-shaped pieces. Clamp pressure is uniform throughout the system, rigidly controlled, indicated by a gauge. Operating pressure is in the 2000 — 2500 psi range. The system is self-contained with no outside source required to maintain pressure. Both screw and lever pumps, equipped with pressure locks, available in two sizes — cylinders in varied size ranges. Air actuated hydraulic pumps, also available in two sizes.

HYDRAULIC SYSTEM PROVIDES:

- **Rapid operation of clamps in jigs and fixtures**
- **Controlled clamping pressure**
- **Self-contained clamping — independent of external power sources**
- **Versatility of clamping applications**
- **Safety, simplicity and economy of operation**
- **A variety of pumps, cylinders and mounting devices**

Send for complete information and catalog.

A Newton engineer will be happy to sit down with you to discuss your particular clamping problem and to give advice on the type of equipment best suited to your needs.

. . . clamps down on set-up time

NEWTON

HYDRAULIC TOOLING CO., INC.

AUBURN, MASSACHUSETTS

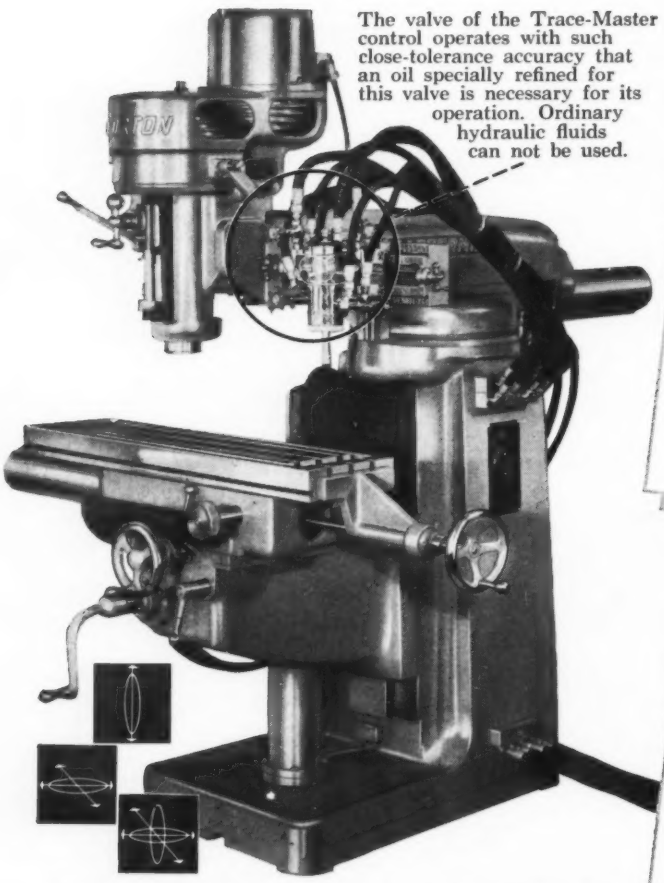
See Newton Systems demonstrated at Detroit A.S.T.E. Show April 21 — 28
BOOTH NO. 1627

CIRCLE INFORM-A-GRAM KEY NO. 39

Designed for the *"Missile Age"*

GORTON "Trace-Master" Mastermil

with exclusive combination of sustained toolroom accuracy and precision-built Trace-Master Hydraulic tracer control



The valve of the Trace-Master control operates with such close-tolerance accuracy that an oil specially refined for this valve is necessary for its operation. Ordinary hydraulic fluids can not be used.

Nowhere Else will you find this combination

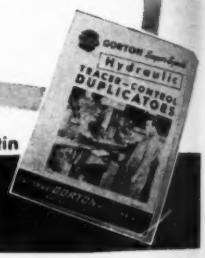
1. TWO H.P. spindle motor
2. Finest Milling Head in its class
3. 80 to 5,600 RPM spindle speeds
4. Rigidity . . . (2,800 lbs net weight)
5. Extra long saddle

Nowhere Else will you find this versatility

1. Production profiling
2. Scanning
3. Duplicating . . . die and mold work
4. Milling . . . conventional and climb
5. Boring

3 Models Available (1) 180° Vertical Hydraulic Feed to Knee (2) 360° Cross Hydraulic Feed to Ram and Longitudinal Hydraulic Feed to Table (3) 3D Hydraulic feed to knee, ram and table for 3-dimensional work.

Trace-Master controls can be furnished with the Model 1-22 Mastermil illustrated above or the Model 9-J Super-Speed Vertical Mill with single spindle, twin spindles and/or six inch higher column for additional vertical capacity.



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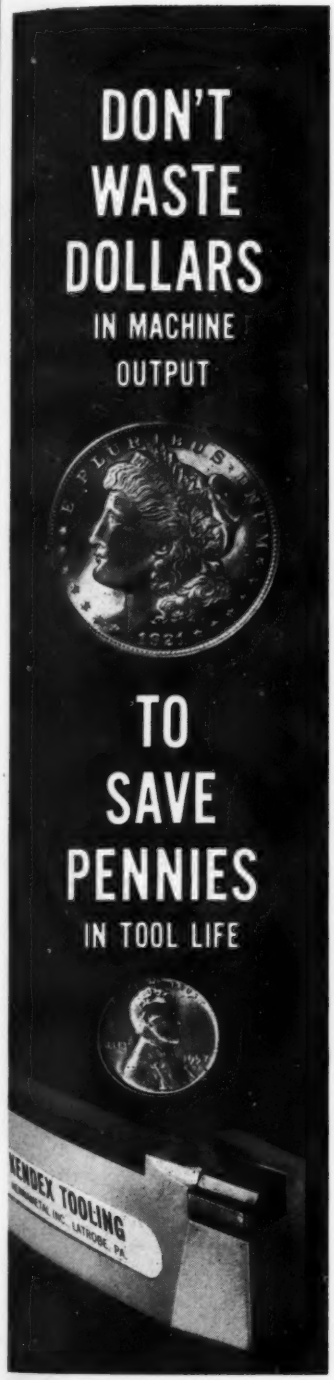

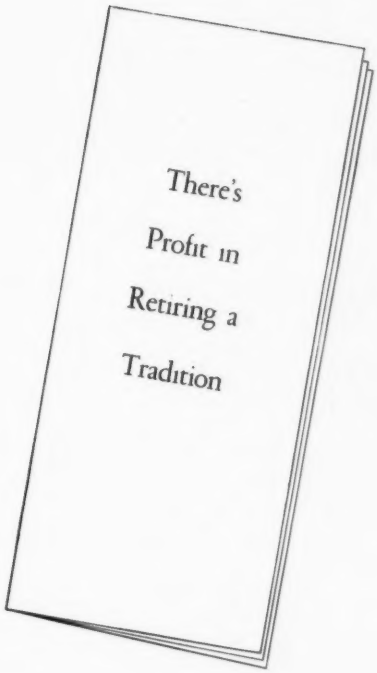

SEND FOR THIS BOOKLET TODAY!

With rising costs and increased competition from both foreign and domestic sources . . . you will find this a timely review of how some shops are reducing machining costs per piece by retiring certain outmoded ideas. As one plant owner did, perhaps you too will conclude . . . "A cutting edge on an indexable carbide insert that costs only a few cents is an extremely small price to pay for the efficient use of machines costing thousands of dollars."

Proof? Check actual on-the-job results shown in the table below

Get the complete story. Send for this booklet today and ask your Kennametal Representative for complete information on how Kendex* (patented) tooling is increasing productivity on many types of machining operations. Write KENNAMETAL INC., Dept. DP, Latrobe, Pa.

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Typical Examples—Same Machines . . . Same Tools . . . Same Workpieces

	Job No. 1		Job No. 2		Job No. 3		Job No. 4	
	240-Minute Tool Life Setup	25-Minute Tool Life Setup	75-Minute Tool Life Setup	25-Minute Tool Life Setup	120-Minute Tool Life Setup	80-Minute Tool Life Setup	120-Minute Tool Life Setup	22-Minute Tool Life Setup
Machine Cost per Hour	$ 8.00	$ 8.00	$10.00	$10.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Tool Cost per Hour	$ .04	$ .40	$ .36	$ .76	$ .14	$ .215	$ .14	$ .77
Cost per 8-Hour Shift	$64.32	$67.20	$82.88	$86.08	$73.12	$73.72	$73.12	$78.16
Pieces per Shift	51	181	8	17	94 hrs./pc.	41 hrs./pc.	8	16
Cost per Piece	$ 1.26	$ .37	$10.36	$ 5.06	$859.16	$377.81	$ 9.14	$ 4.88
Cost Reduction	70%		51%		56%		47%	

NEW

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with No. 0 Timken Bearings

gives increased production and optimum accuracy in

straddle milling

milling

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jig drilling
with either micrometer or "Jo" block setting

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The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

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COLLET CHUCKS ● FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS ● AIR-OPERATED CHUCKS
CIRCLE INFORM-A-GRAM KEY NO. 42

HERE'S TO YOUR MONEY'S WORTH!

WITH 1960'S IMPOSING ARRAY of trade shows, expositions, and conventions competing for your time and travel there's no question of getting your money's worth.

However, with all that's in store you are going to have to work a little harder at it.

Physically, shows are bigger, both in area and in inclusiveness of subjects covered and industries participating with working exhibits. Program-wise, the know-how and show-how are far more advanced, in keeping with the technologies on display.

One of your biggest show-attending projects will be to sift your interests and budget your time on a most discriminating basis.

April, in Detroit, will see the ASTME Tool Show, and in combination with it a program of technical sessions. Between the equipment demonstrations on the exhibition floor, and the great diversity of technical papers, you will need to allocate your hours almost miserly.

Also in April comes one of the year's outstanding disclosures of advanced practices—the Westinghouse Machine Tool Electrification Forum. Sponsored by Westinghouse and programmed by an industry-wide panel of machine tool builders and users, the Forum will mark its 24th anniversary. For many of us it is a blue chip "must."

Just as necessary to the successful manufacture of your product as any machine tool are the techniques of quality control. Thus the American Society for Quality Control is making its bid for your presence at its Annual Convention, May 24-26, San Francisco.

This is always a hard-working convention, a tight schedule of concurrent sessions so programmed that you can make the most of your time and specialty; be it aircraft, automotive or electronics. Here, again, your time is your investment; the know-how is your dividend.

The benefits you can derive from your attendance at 1960's conventions and expositions will vary directly with your success in budgeting your time and effort.

First and foremost is your motivation to investigate all equipment that has a direct-bearing on your manufacturing problems. The best way to streamline your program is, immediately upon arrival, to plot your course. Even an hour spent with the floor plan and list of exhibitors can pay off in minimizing time-consuming back tracking. With your floor plan plainly marked as to the exhibits that you must cover, a glance will give you the most direct route from one to another. This may sound trite, and if you've never been lost in an exhibit hall—okay, just skip it!

Particularly, will you need to organize your coverage of next September's Machine Tool Exposition—the biggest event of all.

Held only every five years, the impact of the new models, new controls, new economic concepts, and new standards of productivity, upon even today's yardsticks of value and performance will be a strain on any last shred of complacency you may be harboring. What has been "good enough" will, in many cases, become obsolete in face of the new disclosures.

Your greatest incentive to cover thoroughly the National Machine Tool Builders' Exposition —to get your money's worth — is knowledge that your competitor is right there on your heels, and for the same purpose.

September 6-16, concurrently with the Machine Tool Exposition will be the Production Engineering Show on Chicago's Navy Pier as well as Chicago's second Coliseum Machinery Show. For you these hold forth more new tools, machines, and methods, many of which will be displayed for your evaluation the first time.

What you will be able to take home from the two Chicago exhibitions can be expressed best in terms of the millions of dollars in research and development which have preceded the realization of the working demonstrations. Some of the equipment has been under wraps for many months and, as of today, some of it has yet to get its final coat of paint.

The American Society for Metals' 42nd National Metal Exposition and Congress will beckon you to Philadelphia, October 17-21. Bulwarked by its over forty years of "seniority" and prestige, with a formal program of missile age metalworking of international scope, the ASM Congress promises you five stimulating days. Research and development reports from top flight authorities, plus a wealth of exhibits covering equipment, instruments, and methods demonstrations, will assure that you will be gaining more than your money's worth.

November will see a grand finale to your year of conventions and exhibitions — your accumulation of know-how and witnessing of show-how. At Los Angeles' Western Tool Show, November 14-18, you may become thoroughly briefed in the outstanding accomplishments of metalworking west of the Rockies.

Truly, 1960 promises you a year rich in new metalworking concepts and disclosures, widely and skillfully communicated via lecture platform, display demonstrations, and open discussions. It's all yours, to be had for the taking—and the harder you work at it, the more you can get out of it. It's your money's worth!

E. Willard Pennington

Editor

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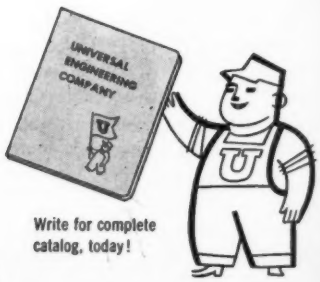

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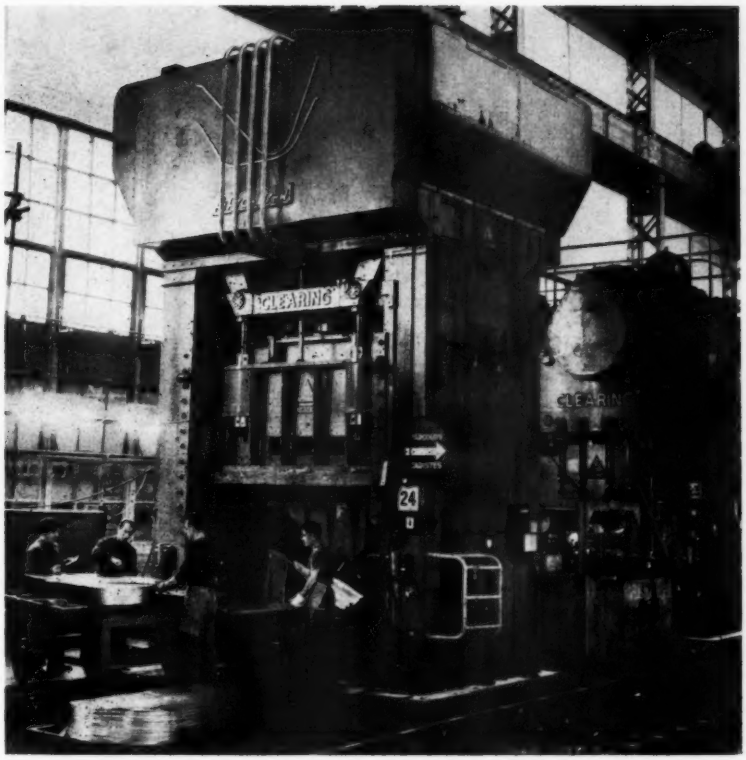


One of 16 Clearing and 12 Bliss presses that form body components for Simca cars. The 1500-ton Clearing forms roof panels.

Cash In On Overseas Expansion

by Stephen W. Kann

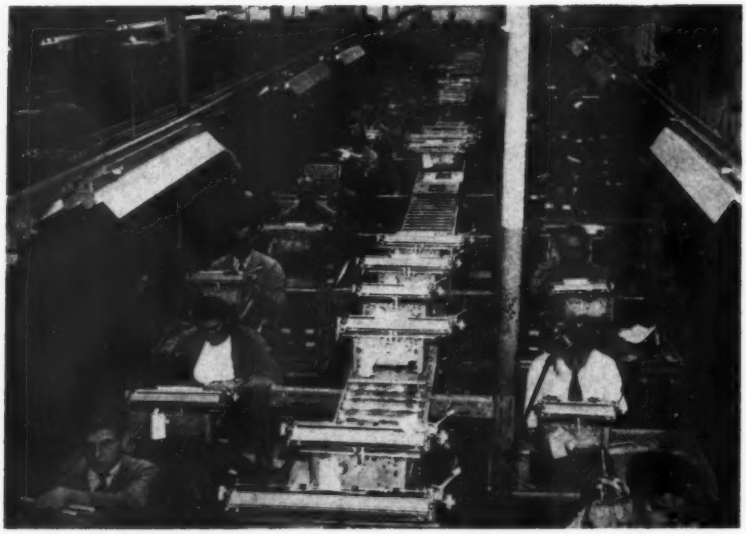
CONTINUED GROWTH of industry overseas presents management of U. S. metalworking plants with both an opportunity and a challenge!

By 1963 the average Latin American metalworking plant plans to increase its output 111%. In the Middle East, metalworking plants expect to expand 49%; in Oceania, 42%, in Africa, 34%. Metalworking plants in the Far East forecast an increase of 104%, while the already industrialized area of Europe predicts a 41% gain. Dollar-wise, the average metalworking plant outside of the U. S. and Canada will spend $193,000 on new equipment in the next two years.

In many foreign countries, industry will be expanding at a faster rate than in the U. S. This means a growing market overseas for a wide variety of U. S. plant equipment and raw materials. It also means more competition from a wide array of products made in foreign plants.

U. S. manufacturers can profit from overseas metalworking expansion by 1) exporting the type of product for which there is a ready market overseas, 2) establishing plants overseas in areas that have high profit potential and cannot be satisfactorily served from the U. S., and 3) putting know-how to work overseas by means of license agreements or plant operating contracts.

Mr. Kann is editor of Industrial World Magazine, which is directed to plant executives outside the United States. From a sampling of his readers engaged in metalworking he has determined their cumulative expansion plans. From field trips to various countries he has been able to add thoughts on how U. S. manufacturers can profit in the expanding world markets.



Assembly line for Royal-McBee typewriters in Leiden, Holland. Typewriters are made for Europe and the Middle East, as well as small portables for the U. S.

Step Up Exports

Last year the U. S. sold an estimated $16.2-billion worth of goods overseas, including some $85-million worth of machine tools. Economists believe that this year our exports will reach $18.5-billion.

Factors that are tending to increase our exports include the general world business prosperity, the shipment of steel mill products that could not be delivered last year because of the steel strike, and the removal of some quota restrictions on U. S. goods.

For the U. S. metalworking plant, concentration on the type of product with which it can beat foreign competition is the best way to increase exports. Price of the product is not the only important factor. Design, quality, and performance are equally vital.

Currently, four basic types of U. S. metalworking products enjoy healthy export sales—special tools, "stripped" chrome-less units, mass produced items, and new innovations.

Special tools, including process equipment and machine tools, will retain a good export market for some time to come. The high volume sales of European cars in the U. S. has been a boon to manufacturers of automotive machine tools. Bullard, for example, has sold more of its Mult-Au-Matic machines to Germany's Volkswagen than to all of Detroit's automakers combined.

Export sales of mass production equipment is being assisted by the formation of larger marketing areas, such as the European Common Market and the Outer Seven. These regional unions will create more competitive business conditions and larger markets. This, in turn, will make it worthwhile for them to adopt U. S.-style mass production techniques.

"Stripped" chrome-less units of both consumer and industrial goods have helped boost export sales for many companies. These low-cost, accessory-free models often have the same high-quality sturdy construction that has given U.S. products their reputation overseas. At the same time they are stripped of expensive doodads that are essential in the U.S., with its market of yearly obsolescence, but mean little in most export markets.

An industrial example of this type of product is the Logan engine lathe; in the consumer field, the compact cars.

Mass production items made in modern U.S. plants can sometimes be manufactured with higher-cost U.S. labor and sold overseas at lower prices than if they were made there. Products of this type are goods for which our high standard of living has created in a large market, but for which the overseas market is still comparatively small. Examples include small gasoline engines, certain portable power tools, high horsepower outboard motors, self-contained room air conditioners, packaged oil burners, hi-fi amplifiers, pleasure cruisers, and industrial heating controls.

New innovations can be a vital factor in export trade. For example, exports of large jet passenger planes will have a bouyant affect on our total overseas trade this year. Overseas shipments of nuclear research and power reactors continue to be an important item. Many U.S.-made instruments, processing machines, plastics, steels, etc., are sold because new developments have made them better than anything available overseas.

In the consumer field, U.S. refrigerators, washing machines, and cars have always enjoyed a small, healthy market in countries such as Germany, France, and England that have well-known plants producing similar products. The purchasers of the U. S. consumer products are the wealthy who want something a little bit better. The growing prosperity and rising standard of living in many overseas areas is expanding this "top cream" market.

For the U.S. plant a new invention, process development, or basic design improvement is a sure way of insuring a healthy business, both within the U.S. and in export. But some firms make the error of first saturating the U.S. market before considering overseas customers.

Companies that have followed this policy found that when they were ready to tackle the overseas market their business had been taken away by a smart foreign copier. It's best to develop the overseas and domestic markets at the same time, and thus build up a world-wide reputation that will help to deter late-comers.

Another factor that tends to aid metalworking exports is the U.S. government's program to boost the sale of U. S. products abroad. Since last year, Development Loan

Fund and some International Cooperation Administration loans contain the stipulation that purchases must be made in the U. S. In addition, the Administration plans to sponsor a short-term export credit insurance program similar to the systems available to German and British manufacturers.

Invest for Profit

During the past few years a steady stream of U. S. manufacturers have set up subsidiaries abroad. These foreign plants can take advantage of low wage rates and the normally higher overseas profit margins. They also help to protect the U. S. company's share of the market from competition, and to boost U. S. exports of components or special models not made overseas.

To date some 70 metalworking machinery manufacturers have established foreign manufacturing arrangements, mostly in the United Kingdom, the nations of the European Common Market (France, Germany, Italy, Belgium, Holland and Luxembourg), Brazil, and Australia.

Many concerns have established new overseas plants "from scratch." Often equipment that has become surplus in the U. S. parent plant is sent abroad. In other instances U. S. companies have bought going concerns overseas.

A third technique, particularly popular with the chemical industry, is the formation of joint ventures with local companies. In such a setup, the foreign company supplies the local management know-how that can be essential in the success of the operation. Sometimes the U. S. company's share is in the form of equipment and process data.

Profit from Know-How

All these techniques require some financial investment. There are also ways of putting know-how to work overseas without risking any money.

The most popular method is to license a foreign company to manufacture your product. In return for their use of your trademark and technical data you receive a royalty—usually a percentage of the unit sales price. In this type of arrangement it is vital that the overseas manufacturer maintains your product quality.

Contracting with an overseas company to produce the product to your specifications, much as a subcontractor, is another popular technique. With this type arrangement you control product distribution. This arrangement has worked out particularly well in the manufacture of items that require considerable plant facilities such as cranes, boilers, radial drills, and paper processing machinery.

Some U. S. metalworking concerns are putting their know-how to profitable use overseas by giving technical advice or operating plants erected for others. For example, Cleveland's Steel Improvement and Forge Company designed, helped build and now operates the forging division of Industrias Kaiser Argentina, a Kaiser enterprise that turns out Jeeps and the Carabela passenger car.

Think Big

Marketing your product overseas requires the same aggressive sales techniques necessary in the U.S. That's why most large corporations no longer consider export as a small off-shoot of the domestic sales department. Instead, they have raised overseas business to the same management divisional level as domestic sales departments.

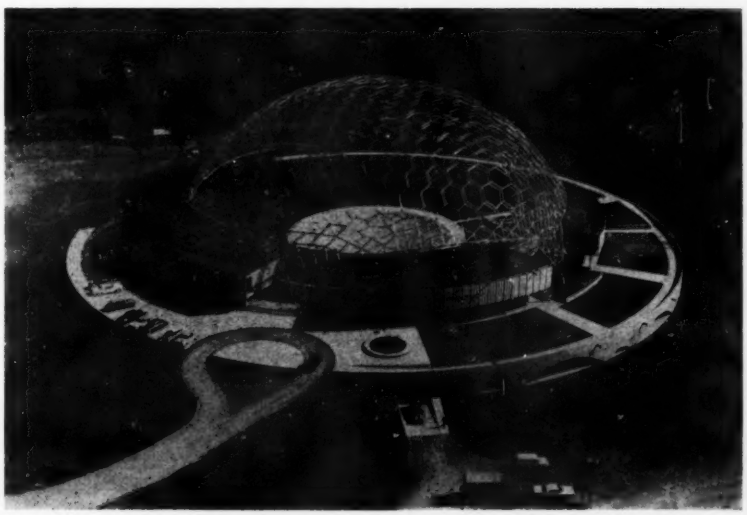
Whether we like it or not, metalworking plants overseas plan to expand. This added capacity will result in more competition for many U.S. products. But, it also gives the farsighted manufacturer an opportunity to participate in the profits to be made overseas.

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Road, Cleveland 18.

Metal Dome Tops New ASM Home

After many years of planning and waiting, the American Society for Metals finally gathered its scattered departments and installed all operations in their new headquarters in Novelty, Ohio. The whole setup of their Metals Park reflects man's utilization of the earth's mineral resources and the new era in the world of metals. It houses all business activities and the Metals Documentation Service, special engineering literature searching system.

The spectacular geodesic dome, says ASM, depicts man's mastery of metals. It is 103' high, has a 250' dia, and is composed of 13 miles of extruded aluminum alloy tubing and tension rods.



Higher Speeds Improved Designs Linked for Production Economy

Over-emphasis on tool life and under-emphasis on machine-time costs is a common fault. Lincoln Electric's approach to machining economy evolves around designing parts that require as little machining as possible, and then machining those parts as fast as possible.

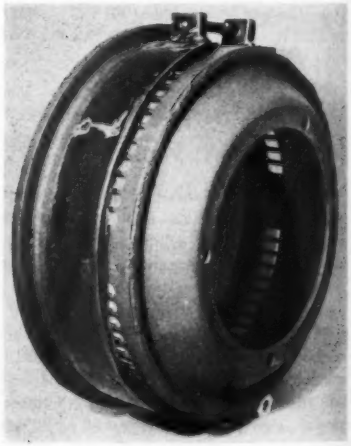
INCREASING MACHINING SPEEDS and reducing the amount of machining necessary, saves money. An analysis of a few of The Lincoln Electric Company's operations points up the possibility and feasibility of this kind of production thinking.

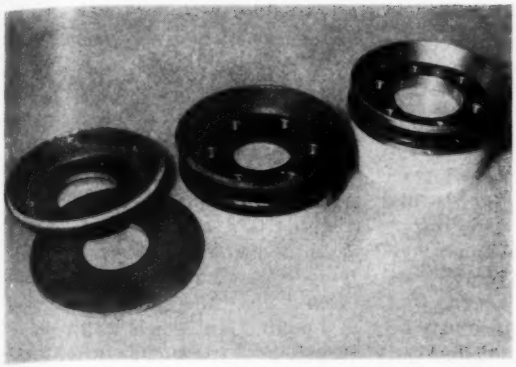
Lincoln started using carbide tools in 1935. Even then, the potential machining cost reductions possible with these tools was obvious. However, their premium price required that application restrictions be set to insure efficient use. Methods Engineering analyzed existing procedures and tool costs and determined that machining had to be done at a minimum speed of 500 sfpm before the additional tool cost could be justified. Top speeds actually reached and used at that time were around 1000 sfpm.

Today, due to improvements in both tool and machine design, the lower limit has been raised, with few exceptions, to 800 sfpm. Maximum speeds for production operations are over 1500 sfpm — all easily within their machines' ranges.

In machining a gasoline engine welder connecting ring assembly, for example, a Gisholt Fastermatic lathe makes a rough face cut, removing 3/32″ of material, at a

Fig. 1. Louvered connecting ring assemblies need temporary banding for rigidity during machining, which is done at 1200 sfpm. Left to right are part, "band," and banded assembly.





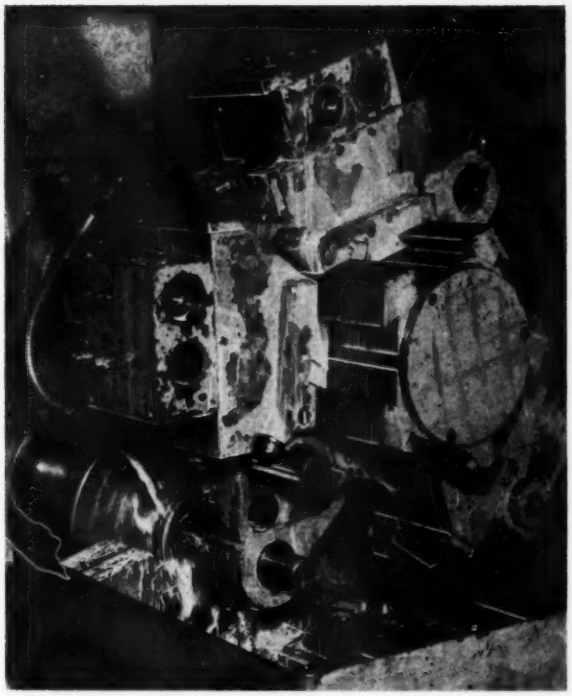


Fig. 2. Warner & Swasey chucking automatic machines commutator caps at 900 sfpm speed. Weldesigned caps (above) in three stages of manufacture—blanks, welded together, and finished.

speed of 1200 sfpm and feed of 0.010 ipr. Other operations on this part include finish facing that surface, rough facing and finishing the opposite surface, and boring and chamfering both ends. All these operations are also run at about 1200 sfpm. Carbide throwaway tools are used for facing, and carbide brazed-tip tools, for rough cutting and chamfering. The grade used is Kennametal K-21.

Design requirements for the finished faces demand that the two surfaces be parallel within 0.002″ tir while in the machine, and 0.007″ when out. Initially this was difficult to accomplish and still maintain production speeds, since the 1/8″ thick walls of the welded assembly are heavily louvered and do not provide rigid support for the face being machined. Temporary banding of the part (Fig. 1) solves this problem.

This is but one of Lincoln's high speed, carbide-tooled operations. Experience has proved that a continuing survey of machining methods and a periodic check of improvements in tool design can result in further cost reductions. Eventually, however, a point is reached where reductions are minor, due to limitations in tool performance and/or machine capacity and capability.

When this point is reached they find it practical to examine the basic design of the part. "Placing" material where it is needed can prove as great a cost reducing tool as good machining procedures. It can also cut machining time. The 1/8″ wall construction of the connecting ring assembly is one result of effective "weldesign" — building up the rough part by welding sections together.

Efficient use of material in a weldesigned commutator cap (Fig. 2) results in better control of manufacturing costs by reducing the amount of machining necessary. In this case, faster than normal machine speeds also help cut costs.

A material saving of 40% and an overall cost reduction of 58% result from the conversion of this part from a forging to a weldment.

The two "doughnut" sections are stamped out from SAE 1020 hot rolled steel. The dished section is drawn from the larger one, and then both sections are welded together, using Lincoln's automatic submerged arc welding process.

Machining includes rough boring, finish boring, four chamfering operations, one rough turn, one taper turn, and a rough face. Although there are many operations, only a small amount of material has to be removed in each one.

All operations are performed on a Warner & Swasey 2AC chucking automatic, at speeds of 900 sfpm and 0.0077 to 0.010 ipr feeds. K-21 carbide inserts are used wherever standard tool forms are required, and modified brazed tip tools are used elsewhere. Machining time is 1.07 min/pc. Average production speed is 40 pcs/hr.

The part in Figure 3 is a shaft coupling. Since this part is used in every engine welder, production is around 1000/mo, and any small saving in production costs has a strong multiplier to make it important.

The function of the part requires developing a centering shoulder on the one surface. An obvious design approach would be to machine the part from 1″ thick bar stock. Immediately, however, this would result in a raw material loss of more than 18% and more than tri-

ple the machining time. So, part components are first welded together to place the basic material where it is needed.

Machining operations on this assembly include rough turning the outside of the blank, facing the welded surface, and turning the centering shoulder. In preliminary operations, 1/16″ of stock is removed at a speed of 700 sfpm and 0.007″ feed. Finish facing is done at 1400 sfpm. All outside corners are chamfered.

The total machining time for the shaft coupling is 0.70 min, and production is 50 pcs/hr. Insert type tooling is used for all operations.

Lincoln has found that production economies resulting from design improvements have been as important to cost control as efficient manufacturing procedures themselves. Since many design modification ideas originate on their production floor, they maintain design flexibility to permit such modifications wherever and whenever possible. A close coordination exists between Design Engineering and Methods Engineering to permit free exchange and rapid incorporation of ideas that offer potential savings.

Tool life is an important factor in all machining operations, particularly when higher speeds are used. Lincoln engineers admit that excessive tool breakage raises tool costs and increases down-time. They have found, however, that this increase in costs must be weighed against the total increase that is encountered when lower speeds are used and fewer parts are produced in a given period. A careful evaluation resulted in the decision to accept a limited amount of tool breakage and maintain higher machining speeds. The excessive tool breakage limit includes a time allowance of 1% per tool job for tool maintenance and replacement. This means that 5%, or 5 min out out of every 100, is allowed on a job where five tools are used. If replacement and maintenance time exceeds this, the machine is not functioning properly, or the material or tool quality is not up to par.

When a new operation is set up, maximum operating feeds and speeds are established by the Methods Engineer, who uses past experience on similar operations as a guide. On multiple cut operations the machining speed is usually increased until a machine stall occurs. The final speed is reduced to a point slightly below this point. Reductions from the established speeds are made only if tool breakage exceeds the allowed limits.

High speed operation has not reduced machine life at Lincoln Electric. Some of their lathes have been operating at speeds as high as 1500 sfpm on a daily basis for well over 10 years.

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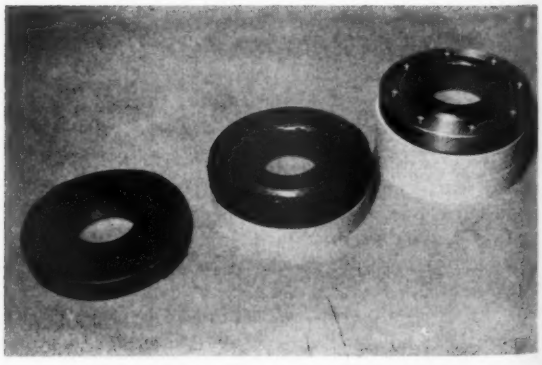
Fig. 3. Build-up of shaft coupling on which finish facing is done at 1400 sfpm. Welding station (left) is conveniently tooled for high speed operation.



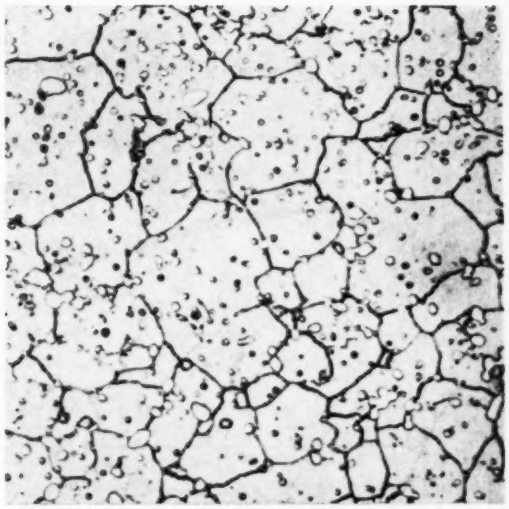


Fig. 1. Typical microstructure of high speed steel in untempered condition (1000X). The structure consists of undissolved carbides dispersed in grains of austenite.

Heat Treatment of Tool Steels

by Edward A. Steigerwald, PhD

TO OBTAIN MAXIMUM TOOLING OUTPUT in a given application, the "ingredients" of steel type, heat treatment, tool design and manufacturing procedure must be properly blended. Although each of these components is an equally important link in the resultant tool, the heat treatment represents the most abused factor from a metallurgical viewpoint. Improper heat treating practices, which do not become evident in relatively simple applications, can result in excessive downtime and subpar performance when applied to today's difficult jobs, such as the working of high strength missile and aircraft alloys.

The heat treatment of tool steels, although always comparable in principle to the standard quench and temper techniques (see T&P, July '59, p. 48), often involves important modifications of the conventional cycles. These modifications generally determine optimum tool steel performance for a particular application.

Tool steels can be defined in a number of ways. The most meaningful, however, is merely to say that they are steels used for tools. This definition may sound trite, but it is worthwhile, since the tool steels, which encompass a wide variety of grades are generally classified by their particular application rather than a specific composition. Certain compositions are employed because they provide the material with properties desired for a specific use. It is on this basis that the tool steels are classified into five categories: carbon, non-deforming, shock-resisting, hot-work die, and high speed. Table 1 gives representative compositions for each of these grades.

Principles of Hardening

The basic methods for heat treating the carbon, non-deforming, and shock-resisting steels embody no major differences over those normally employed by alloy steels. Steel at room temperature consists of two phases: 1) ferrite, which is essentially iron that has very small amounts of dissolved carbon and alloying elements, and 2) carbides, which are composed mainly of alloying elements and carbon.

To be hardened, the steel must be heated above a certain temperature, where the ferrite transforms to another structure called austenite. The quantity of carbon which the austenite is capable of accepting depends on the temperature, and this quantity decreases as the temperature is lowered. If the austenite is quenched at a sufficiently rapid rate the carbon is not able to precipitate out of solution and remains "trapped" in the structure.

The "trapped" carbon produces a supersaturated solution in ferrite, which is called martensite. It is the capacity of the steel to keep the carbon in solution and undergo the martensitic transformation, which is the important factor in hardening. If the steel is not quenched rapidly enough the carbon precipitates, resulting in a material of lower than maximum hardness. Carbon comes out of solution more slowly in steel with increasing amounts of alloying elements. Hence, these steels are re-

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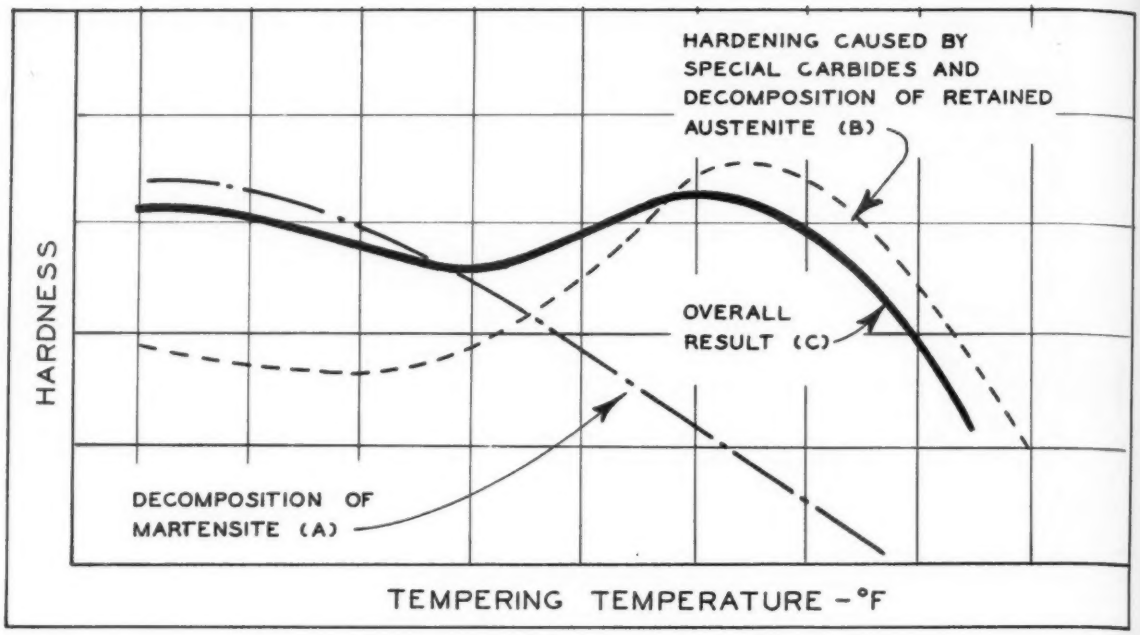


Fig. 2. Schematic tempering curve for a high speed steel showing contributions of individual factors. Curve A depicts normal softening of martensite, and B represents hardening contribution produced by precipitation of special carbides and decomposition of retained austenite. Curve C is the overall change in hardness as a function of temperature produced by the summation of contributions in A and B.

ferred to as having greater hardenability.

In order to produce martensite in the carbon tool steels, water quenching is required. Even with this drastic cooling the interior of a tool made of this grade of steel does not cool rapidly enough to harden fully. As a result, carbon tool steel parts generally have a hard, wear-resistant surface and a softer interior. These qualities make carbon steel undesirable for uses such as dies, which require regrinding operations.

The non-deforming steels have sufficient alloying elements to allow them to be quenched in oil or in air and still form martensite. The less drastic quench decreases the tendency for quench cracking and large dimensional changes due to warpage. Non-deforming steels are, therefore, well suited for intricate dies since the probability for cracking is reduced and finish machining in the hardened condition is minimized. The shock-resisting steels are similar in character to the non-deforming steels. However, they have lower carbon content, which produces improved toughness at the expense of some hardness.

All of the tool steels require tempering or drawing after quenching. The as-quenched martensite in the relatively high carbon tool steels is extremely brittle and practically useless as a tool material. Tempering, which involves heating for periods of time greater than one hour and at temperatures above 400°F, greatly reduces the brittleness of the martensite but does not produce an excessive decrease in hardness and wear resistance.

Aside from the relatively high carbon content, the tool steels and heat treating methods thus far described do not present any marked deviation from conventional procedure. The hot-work die steels and the highly alloyed high speed steels, however, require practices which make the heat treatment of these steels unique. In addition, they are the most interesting from a practical standpoint since they bear the brunt of the high production applications.

The following discussion is centered around the heat treatment of

Table I

Representative Compositions of Alloying Elements for Five Grades of Tool Steel (In % Weight)

	C	Mn	Si	Cr	V	W	Mo
Carbon	1.00	0.25	0.25				
Non-Deforming	0.90	1.60	0.25				
Shock-Resisting	0.50	0.60	0.25	1.00	0.20		
Hot Work	0.35	0.30	1.00	5.00			1.50
High Speed:							
T-1	0.70	0.30	0.25	4.00	1.00	18.0	
M-1	0.80	0.30	0.25	4.00	1.00	1.50	8.50

the high speed steels in terms of their austenitization, quenching, and tempering. The hot-work die steels are generally similar in their fundamental problems; only the specific temperatures are different.

Heating High Speed Steels

Due to the presence of relatively large quantities of molybdenum or tungsten, the high speed steels must be heated to temperatures of 2150° to 2350°F, for hardening. The austenitizing or hardening temperature is a sensitive regulator of the hardness and toughness of the heat treated material. If the austenitizing temperature is too low, a small amount of carbides will dissolve in the austenite and the "free" carbon present will be reduced. This results in lower than maximum hardness. High austenitizing temperatures will increase hardness by increasing the amount of carbon in solution. However, this can lead to excessive brittleness.

A sensitive balance exists between the number of carbides and the carbon content of the austenite, and a wide variety of mechanical properties can be produced by varying this balance between micro-constituents. The proper austenitizing temperature for a given application is generally determined from experiment and service experience. In applications where good toughness is necessary, the hardening temperature is lowered to produce a low carbon martensite. When toughness is not a strict requirement and hot hardness is necessary, as in single-point cutting tools, the hardening temperature is raised to the high side of the allowable range.

A typical microstructure for a high speed steel at the proper austenitizing temperature is shown in Figure 1. The structure consists of undissolved carbides dispersed in grains of austenite. Aside from determining the carbon content of the austenite, the carbides also impart some wear resistance to the high speed steel.

In most tool applications, and particularly in cutting tools, the surface plays the greatest role in determining performance. Because of this factor, and the limited amount of machining performed on tools after heat treatment, it is essential that the steel undergoes no decarburization during the hardening operation. Due to the very high austenitizing temperatures involved, loss of carbon from the surface occurs rapidly under even slightly oxidizing conditions and neutral salt baths or protective atmospheres must be used.

When the tool is complex or massive in shape, preheating at 1350° to 1550°F must be employed before austenitization to avoid cracking. The time at the preheat temperature is not critical provided temperature equalization is attained. A good rule of thumb for relatively simple tool shapes is to preheat all tools with cross-sectional areas greater than one square inch.

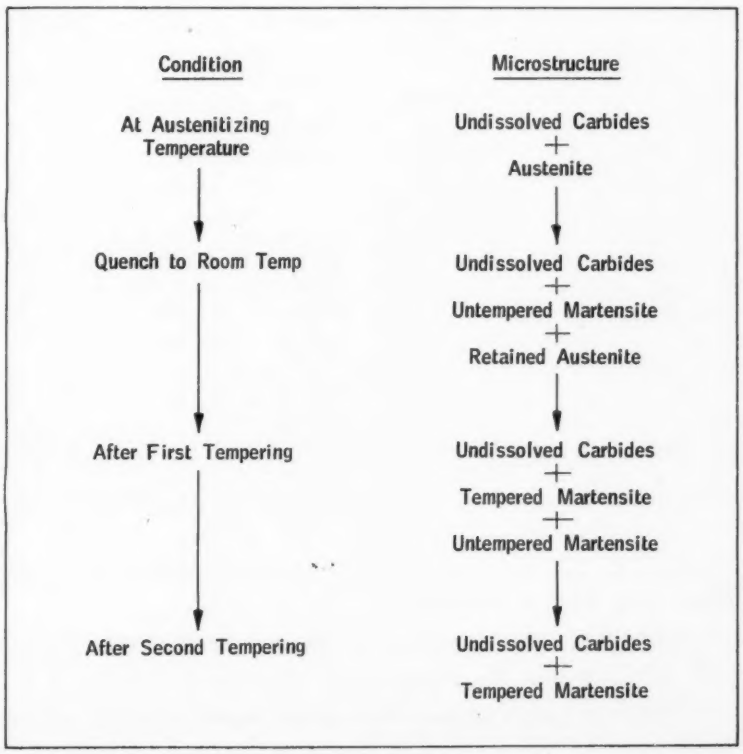
Cooling Rates

The essential feature in the harding of steel is to quench at a rapid enough rate to avoid forming the softer transformation products from the austenite structure. For high speed steels oil quenching is usually employed to obtain maximum hardness, and in certain applications air cooling is adequate.

In cases where complex tool shapes are encountered, step quenching is used to reduce the tendency for cracking due to the drastic temperature change produced by quenching directly to room temperature. The step quenching is done by removing the tool from the austenitizing furnace and quenching into molten salt at 1000° to 1200°F. Temperatures above 1200°F should be avoided since carbon will come out of solution reasonably fast at the higher temperatures, resulting in decreased tool hardness.

Once the tool has equalized at the intermediate temperature, it can be air cooled. An alternate procedure frequently employed for complex or massive tools is to oil quench until the tool just loses its

Fig. 3. Sequence of microstructural changes which occur during the heat treatment of high speed steel. The final tool structure consists of undissolved carbides and tempered martensite for the best combination of wear resistance, hot hardness, and toughness.


Condition
Microstructure
At Austenitizing Temperature
Undissolved Carbides + Austenite
Quench to Room Temp
Undissolved Carbides + Untempered Martensite + Retained Austenite
After First Tempering
Undissolved Carbides + Tempered Martensite + Untempered Martensite
After Second Tempering
Undissolved Carbides + Tempered Martensite

cherry red color and then remove it from the oil bath for air cooling. During quenching, it is essential that the tool be allowed to cool to room temperature before the subsequent tempering operation.

After quenching, all of the structure is not martensite; undissolved carbides and austenite which did not transform are also present. Both the undissolved carbides and martensite have been previously discussed, but the important causes and effects of retained austenite require further clarification. As a steel is quenched the austenite starts to transform to martensite at a characteristic temperature known as the M_s temperature. As the temperature is lowered progressively below M_s, increasing quantities of martensite form until the structure is practically 100% martensite at a temperature designated as M_f.

In low alloy steels for example, the M_f temperature is above room temperature, so a quenched steel microstructure is 100% martensite. In a highly alloyed steel, however, both M_s and M_f are lowered until, in the high speed steels, the M_f temperature is below room temperature and the quenching operation results in the retention of approximately 20% of untransformed austenite. After quenching, therefore, the microstructure of high speed steel consists of approximately 15% undissolved carbides, 65% untempered martensite, and 20% retained austenite.

The retained austenite is a very soft ductile phase, which decreases hardness and is undesirable from a tool performance standpoint. Because the austenite is soft, however, it takes a permanent "set" easily and tools can often be satisfactorily straightened after quenching and before tempering. An additional procedure is to do straightening during air cooling, before the tool reaches room temperature.

Tempering

The tempering procedure for high speed steel decreases the brittleness of the martensite, causes the retained austenite to transform to martensite, and produces secondary hardening. Figure 2 shows the contribution of the hardness of the two competing processes which occur during tempering. As the draw temperature is raised, the hardness of the martensite decreases in the conventional manner as shown in curve A. Due to the high alloy content in this type of steel, however, a special type of carbide precipitates in the 950° to 1100°F temperature range, having the effect shown in curve B. This carbide and the martensite formed from retained austenite produce hardening which counteracts the initial softening effects. The overall result is depicted in curve C, which indicates a maximum hardness being attained at a relatively high tempering temperature.

Since the tempering operation is performed at 950° to 1100°F, the steel can be exposed to lower temperatures in service without suffering a hardness decrease. This is the property which has governed the metallurgical design and selection of high speed steel for hot-work die applications and high speed cutting tools.

After an initial tempering operation, the microstructure consists of undissolved carbides, martensite produced from the initial quench which has been tempered, and newly-formed martensite which has resulted from cooling the retained austenite from the tempering temperature. The untempered martensite formed from retained austenite possesses the characteristic brittleness of freshly-quenched martensite, so for most applications tool steels should be double-tempered. Leaner grades of tool steels possess virtually no retained austenite after the initial quench and require no double tempering treatment.

A second tempering operation serves to decrease the brittleness of the newly-formed martensite and the ultimate structure contains undissolved carbides and tempered martensite (Fig. 3). This final product produces the optimum in properties and performance since the carbides impart some degree of wear resistance, and the tempered martensite supplies hot hardness and sufficient toughness.

Tempering should be performed as soon as possible after cooling to room temperature in the quenching operation. In many cases the very high residual stresses present in a tool will be triggered by slight changes in room temperature, and parts can crack while on the furnace room floor before tempering.

The function of sub-zero cooling, which is sometimes employed for tool steels, can also be explained on the basis of the role of retained austenite. Sub-zero treatment lowers the quench temperature to below M_f so that 100% martensite is formed. In many cases where a tool is improperly heat treated (for example, not allowed to cool to room temperature before tempering) an excessive amount of austenite is present and sub-zero treatment can help. However, in the majority of cases, when the proper quench and double-temper cycles are employed, sub-zero cooling offers no distinct advantages.

Proper heating, quenching, and tempering all play an important part in producing the desired microstructure for optimum tool performance. Each of these factors can be properly controlled to produce a tool having the desired combination of hot hardness, wear resistance, and toughness.

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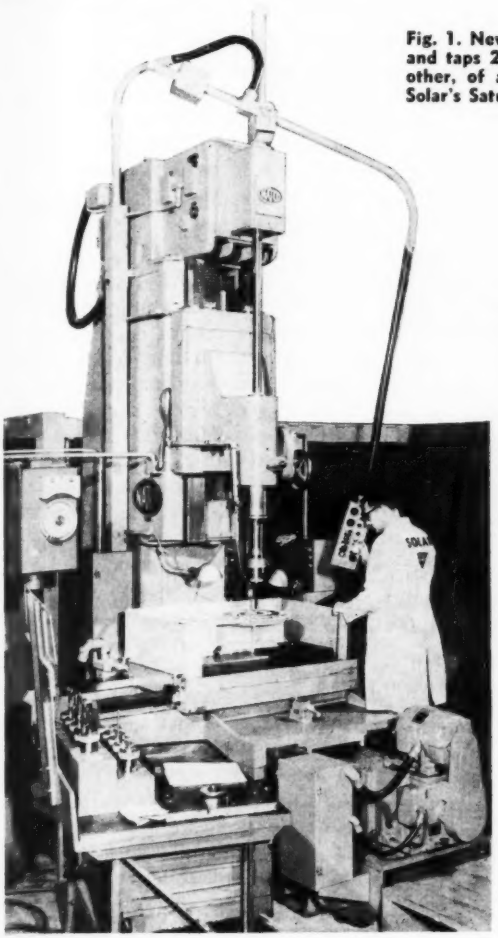

Fig. 1. New tape controlled drill press automatically drills and taps 20 precision holes on one side, and 24 on the other, of an air inlet and accessories drive housing for Solar's Saturn 1100-hp gas turbine engine.

Tape Control Speeds Solar's Turbine Program

Natco Drill cuts leadtime and saves thousands of dollars that might have gone into single purpose jigs and fixtures.

POINT-TO-POINT numerical control has been enlisted by Solar Aircraft Co. to improve critical drilling and tapping operations.

Solar manufactures aircraft systems and components, electronic systems, and industrial expansion joints, but it is especially noted for its compact and powerful gas turbine engines.

In the transition from the prototype stage to production on a new model of the Saturn 1100-hp gas turbine engine, they were faced with manufacturing volumes too great for manual jig borer operations, and wished to eliminate the cost of elaborate fixturing for drilling, counterboring, and tapping many of the engine components. The answer for Solar was a Natco tape controlled drilling and tapping machine, made by the National Automatic Tool Co.

The heavy-duty, single-spindle machine has 3-axis control, which gives point-to-point location and milling feeds in the horizontal (x and y) axes; and feeds, speeds, spindle reverse, and depth control in the vertical (z) axis. Tool changing is manual, but is speeded by quick-change toolholders.

This new machine can drill, bore, ream, counterbore, tap, step drill, jump feed, spot face, and do straight line milling. Its spindle is powered by a 4-speed, 7-1/2-hp reversing motor, operating through a 4-speed gear unit, which gives 16 speeds ranging from 100 to 1520 rpm. Head traverse, powered by a fluid-type reversing motor, provides feed rates from 1 to 15 ipm, in 1 ipm increments, through a vertical distance of 24″.

The positioning table has a 24″ x 36″ work surface and can move through a 24″ x 36″ range. Spindle clearance permits machining workpieces up to 24″ high.

Both head and table are positioned to ±0.002″ accuracy by precision ground ball-screws. Movement of head occurs in two degrees, without hesitation: Rapid approach at 200 ipm to within 1″ of location; then controlled slowdown to within 0.1″ of location. The programmed spindle feed rate takes over at this point.

Table positioning is as follows: It approaches within 1″ of location at 165 ipm. It then travels at 28 ipm to within 0.1″, 2 ipm to within .01″, and finally at 0.3 ipm

Fig. 2. Quick-change toolholders help speed drilling, counterboring, and tapping of 44 holes in the workpiece.

to final location. Upon reaching final location the signal light comes on and the table or saddle movement must remain in accurate location so that the inter-lock, permitting head movement, can operate.

The numerical control system which actuates machine movements is also a Natco development. It is primarily electro-mechanical, directed by a standard 1" 8-channel tape. Coordinate dimensions, derived directly from the drawings, and other directions to the machine are punched into the tape on a Flexowriter, according to a standard code.

When the punched tape is in the tape reader adjacent to the machine, electrical impulses are transmitted from its hole patterns through a stepping relay to memory units in the control cabinet. These retain the dimensional and auxiliary information, and through a parity check prove the correctness of the information.

When the operator pushes the Start button the motor-driven lead screws which move table and head are clutched in, and digital converters begin to count revolutions at the screws, constantly comparing slide locations with command data stored in the memory. The digital converters signal motor controls when to reduce speed and when to stop at final location.

After each machining operation a reverse switch clears the memory unit. During head withdrawal, the tape reads entries for the new location and depth into the memory unit and re-energizes the controls for the next operation. Actual hole-to-hole movement, exclusive of cutting time and tool changing, takes about 8 sec.

Vertical feeds may be programmed for the best feed rate consistent with the requirements of finish and the nature of the cutting tool, but when "accurate depth" is signalled, the cut is automatically finished through the final 0.1" at 0.5 ipm feed rate. In normal cycle drilling, drills are carried to depth with no slide feed rate slowdown. A typical drilling cycle would be programmed:

1. Table and saddle location.
2. Begin feed.
3. End Cut.

Solar is presently programming 40 drilling and tapping jobs for the Natco drill, for on such varied Saturn gas turbine parts as the combustion chamber case, bearing support, compressor case, and turbine nozzle. Materials range from aluminum alloys to A-286 alloy steel and 422 stainless. They estimate that the drill has saved $35-000 in the cost of jigs alone for the Saturn engine program.

In a few months Solar will install a standard production model of the same machine, which will incorporate additional spindle speeds at the high and low ends of the scale (50 to 3000 rpm) and have hydraulic table drive motors instead of the electric motors. The Natco now in use there is a prototype, which will be returned to Natco for experimental work, and for production of their machines.

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Fig. 3. Compact numerical control console makes provision for manual as well as fully automatic operation of the machine. Dials permit operator to set dimensions directly on X, Y, and Z axes, and choose speeds and feeds without touching the machine, if necessary.

Two Innovations In Progressive Die Design

by Federico Strasser
Santiago, Chile

For your die designers, die makers, and, particularly apprentices, here are two neat tricks to add to their "know-how inventory." Tomorrow, two weeks, or two years from tomorrow, Mr. Strasser's practical, shop-proved examples could well save valuable trial and error time.—*E.W.P.*

Progressive Die Produces Reinforced Stampings

FIGURE 1 DEPICTS a stamping which we have had to produce in comparatively large quantities.

Ordinarily, such a workpiece might be made first in flat form in a two-station progressive die for the hole punching and blanking; leaving the reinforcing rib to be formed in a separate, second-operation die. In this case, however, due to metal behavior (or misbehavior) we had to resort to a different procedure.

Note the proximity of the reinforcing rib to both the outer profile and the two smaller holes. This made it essential to form the rib before the respective small hole punching and blanking operations. Otherwise, both the blank (outer) contour and the small holes would have been distorted and/or displaced.

Accordingly, we incorporated the rib-forming operation in the one progressive die which produces the completed piece, and with the operations so sequenced as to avoid any trouble from distortion. Thus we not only solved the technical problem, but we also enjoyed appreciable economic advantages by eliminating an expensive secondary operation. Additionally, the total cost has been reduced appreciably.

The strip development from the resulting die is shown in Figure 2. The die is a three-station progressive die. With the strip feeding from right to left, at station #1 the larger hole is punched and the reinforcing rib is formed. Both op-

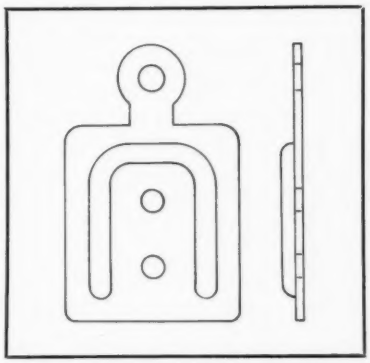

Fig. 1. The formed rib in this stamping posed the problem of avoiding distortion.

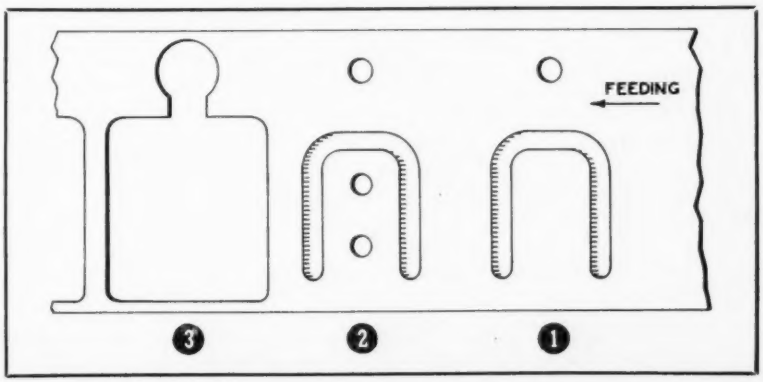

Fig. 2. This sequence of operations insured accuracy of small hole locations by first forming the rib.

erations are effected with conventional tool members — the hole punching with a round sharp punch and a die ring, and rib forming by male and female embossing stamps. Thus at station #1 the metal has been subjected to its maximum deformation and with no effect on significant dimensions.

At the second station, the two smaller holes, situated between the legs of the reinforcing rib are punched. Also, at station #2 the hole punched at the first station is utilized for piloting, thus aligning the strip in correct relation to the die members.

Also, in the die plate of station #2, a recess has been milled, matching the rib profile as formed in the first station. This is necessary in order to avoid deformation of the rib during the punching of the two small holes.

Finally, in the third station, the finished workpiece is blanked out from the strip.

As is customary with multi-station progressive dies, in order to avoid unnecessary stock loss at the beginning of each strip, double click stops may be provided at the entry side of the tool.

A Convertible Progressive Die

This doesn't mean that you'd ever run this die with the top down— but rather that it can be quickly converted from producing one design of workpiece to another!

We had to produce two sizes of L-shaped stampings, according to Figures 3 and 4, from light brass stock, and, in relatively short runs. Actually, the only differences between the two workpieces were in the dimensions given in Figures 3 and 4; the lengths of the short legs of the L's, and, consequently, the hole locations. The holes were all the same size.

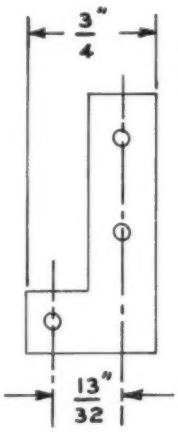

Fig. 3. This long-legged version of the stamping is produced by the die as arranged in Figure 6.

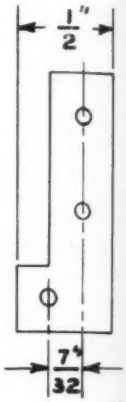

Fig. 4. With the die converted to Figure 7, the stamping differs in these dimensions from Figure 3.

At first thought the simplest solution for this program would have been to make a die for the larger piece (Fig. 3) and punch and blank a quantity adequate for both sizes. The desired number of small pieces would be attained by a shearing operation on the leg of Figure 3, thus shortening it to the length of Figure 4. This proposal was not economical; too much waste of stock and labor. Further, the loss of the (third) hole in the shearing operation would call for an extra hole punching operation in the shortened leg to give us Figure 4.

Another seemingly easy solution would have consisted of making two dies — one for each workpiece. In the present case, this idea was most uneconomical because of the short runs involved.

Our solution as finally realized was that of one progressive die

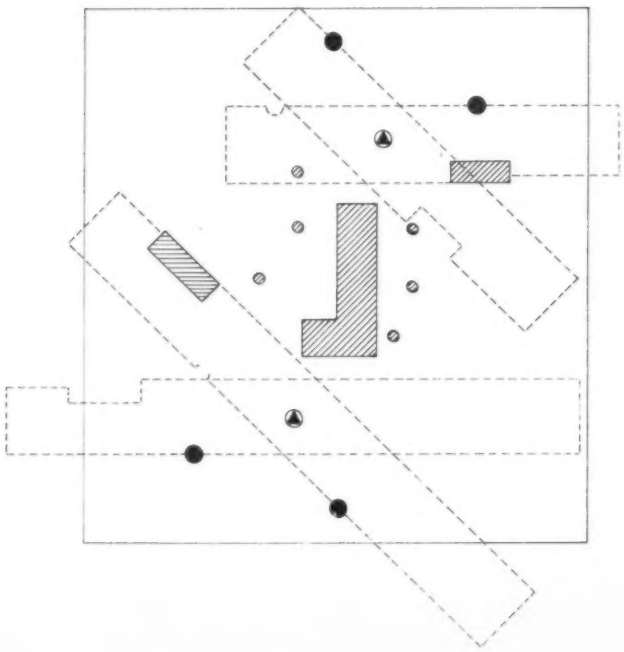

Fig. 5. The alternate positions of the stock guides, the repositioned hole punches, and the substituted side cutter are shown in blue.

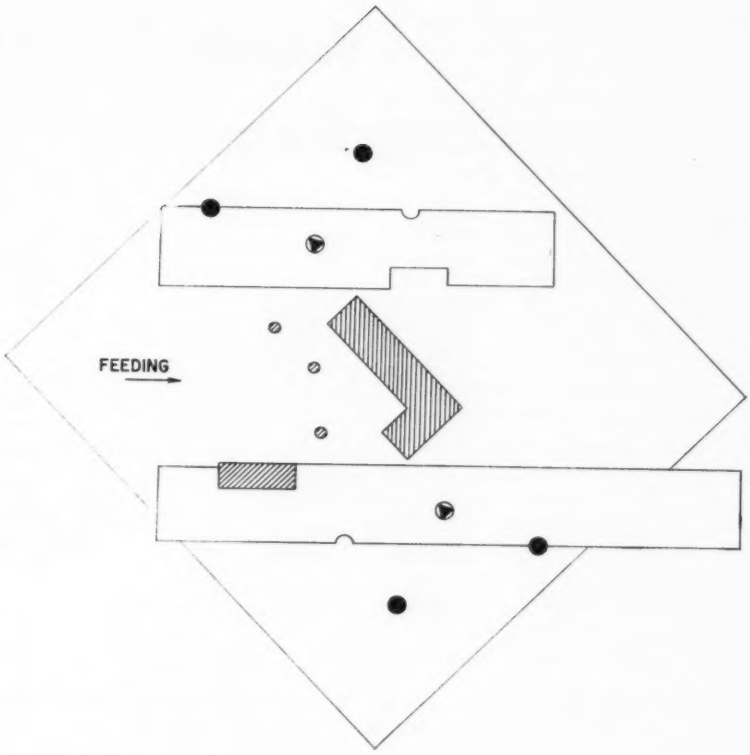

Fig. 6. Feeding the strip from the left, with the die arranged according to the black lines of Figure 5, produces the stamping of Figure 3.

used for the production of either component, Figure 3 or Figure 4. The die is of quite standard design, with only a few members subject to either substitution or repositioning. These changes are quickly and easily made when production is changed from one stamping to the other.

As shown in Figure 5, we made a progressive die with one central blanking station and two piercing stations—one on each side of the blanking punch. The two piercing stations conform, respectively, to the hole patterns of Figures 3 and 4.

The operation of our die is such that the strip is fed not only in opposite directions, but also at different inclinations with respect to the L-shaped blanking punch when producing one or the other workpiece, i.e., either Figure 3 or Figure 4.

Figure 5 shows how our die may be converted from one arrangement to the other.

The pair of stock guides may be pivoted and screw-locked in either of two positions. The permanently mounted blanking punch is not changed. The hole piercing punches may be changed in the punch holder to conform to either hole pattern. The side-trimming, or "frenching" punches are demountable and are of unequal length. The longer one, only, is used to size the strip at each press stroke in producing the workpiece of Figure 3; the shorter one, serving to index the strip feed when producing the blank of Figure 4.

Thus the die, Figure 5, may be set up to conform to Figure 6 for blanking the workpiece of Figure 3.

For producing the workpiece of Figure 4, the die is arranged or converted to Figure 7. Note that with the setup of Figure 7, the shorter frenching punch gives an increment of strip feed or pitch which results in the shorter leg called for in Figure 4.

This uniquely convertible die has been found highly satisfactory in all respects: low tooling cost, maximum stock utilization, and low labor costs.

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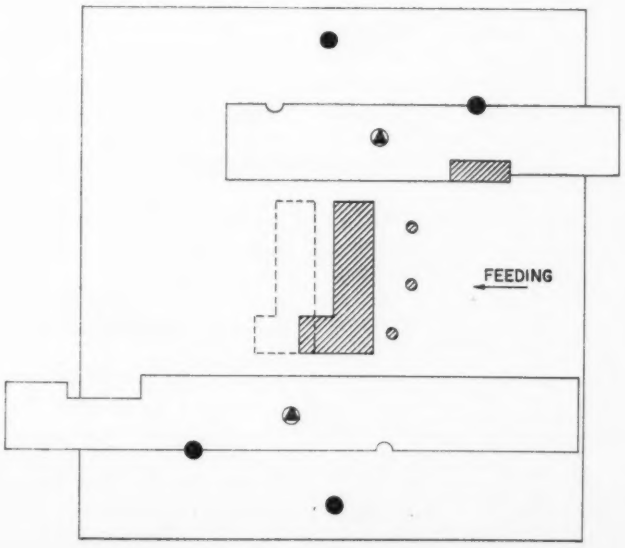

Fig. 7. Feeding the strip from the right, with the die arranged according to the blue lines of Figure 5, produces the stamping of Figure 4. Note how the shortened pitch or feed permits the one fixed blanking punch to produce stampings with two different leg lengths.

Close Tolerance Reaming

by Harold Sedlik

CONSIDERABLE ECONOMY in metalworking production operations is achieved when precision holes can be produced by reaming. Cost economy is a result of the production of close tolerance holes without the need of grinding or lapping.

It is feasible on a production basis under controlled conditions to produce holes to within 0.0002″ or less. To successfully ream within such close tolerances, one must give proper consideration to several basic principles that are often overlooked or disregarded.

To begin with, under favorable conditions, a reamer will produce holes slightly above its own size. How much oversize will depend on the material. (See Table I.).

Also, when selecting a standard commercial reamer for a particular diameter, manufacturing tolerances must be considered (See Table II.).

Therefore, when holes are to be produced to close tolerances, a reamer must be carefully measured with a micrometer to select one as close to the desired size as possible. However, if oversize, the tool can be reduced in diameter by running it backwards in a reamed hole, preferably in cast iron.

Let us assume we are to ream a hole 0.625″ (+ 0.0005, —0.0000) in steel. Since the maximum hole diameter may be 0.6255″, we must remember the reamer will cut 0.0005″ over its own diameter. Therefore, the reamer will be at least 0.0005″ smaller than the maximum diameter of the hole. Allowing 20% of the hole tolerance, or 0.0001″, for the margin of safety, one may use a reamer of 0.0006″ under 0.6255″, or 0.6249″ diameter.

Theoretically, this 0.6249″ machine reamer should produce holes 0.6254″ in diameter. The 0.6249″ reamer is calculated to produce holes near the maximum size to allow for considerable tool life. However, should the reamer cut oversize, it can be lapped as previously stated.

Table I

Amount Reamer Will Cut Oversize Under Ideal Conditions* (Up to 1½″ dia)

Material	Amount (Inches)
Aluminum	+0.0004″
Brass	+0.0003″
Cast Iron	+0.0004″
Steel	+0.0005″

***Data derived from research conducted by the author and should be used only as reference.**

Speed, feed and stock removal are important factors when precision reaming.

Speeds for machine reaming may vary considerably depending on material, type of machine, etc. In general, most machine reaming can be done at one-half the speed commonly designed for drilling.

Feeds for reaming are usually much higher than those employed for drilling, often two to three times greater. Feeds should be sufficiently heavy to prevent glazing. However, too high a feed may reduce the accuracy of the hole and impair the finish. The basic idea is to use as high a feed as possible and still maintain the required finish and accuracy.

Insufficient stock for reaming may result in a burnishing rather than cutting action. Too much stock often causes oversize, or rough, holes. Consequently, a certain amount of experimenting may be necessary.

Most reaming operations require a coolant or lubricant, except

Table II

Manufacturers' Standard Reamer Tolerances (Adapted from American Standard ASA B5.14 1941)

Nominal Diameter (Inches)	Tolerance Above Nominal Diameter
Up to and including 1/4″	+0.0001″ to +0.0004″
Over 1/4″ to 1″	+0.0001″ to +0.0005″
Over 1″	+0.0002″ to +0.0006″

Mr. Sedlik is Tool Designer for Stanley Tool Works, New Britain, Conn.

cast iron, which is usually reamed dry. The use of a coolant will prolong tool life and improve the finish of the hole. Also, a good point to remember: Should a reamer cut slightly oversize, flood it with coolant. A tool flooded with coolant will have a tendency to cut undersize. The amount of coolant used will generally have a direct influence on the finished hole size. On a production run, the flow of coolant should be constant and controlled.

Misalignment between reamer and work will cause bellmouth, tapered, and out-of-round holes. This can be prevented with the use of a floating holder. There are several types of good floating holders on the market, some of which permit an angular float; others, a parallel float; still others, both. When a reamer is held without a floating holder or rigidly in a machine, the tool must be checked for misalignment and concentricity.

Where extremely accurate, smooth holes are to be produced there is no better tool for the job than a properly made carbon steel straight-fluted reamer. (Straight fluted reamers are preferred when accuracy is required.) A carbon steel reamer will maintain its keenness longer than a high speed steel reamer; however, after the keenness is worn, the high speed steel tool will last longer before it reaches the breaking down point. When the keen cutting edge of a reamer is worn, the tool is unfit for service where a smooth hole of great accuracy is required.

Carbon steel reamers are only recommended when accuracy is of utmost importance and tool life and production secondary.

The advantages of close tolerance reaming are economically favorable because of the possibility of eliminating two expensive operations, grinding and lapping. These advantages should not be overlooked by any company that is seeking means to cut cost in today's competitive market.

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Supervisory Development: A Critique

by E. C. Bentzen

FEW BUSINESSES operate at anywhere near the level of their potential efficiency, and one of the prominent reasons is that the supervisors lack competence and drive. As one superintendent put it, "All of the knuckleheads are not in the union." And, because they are supposedly the spark plugs, the effectiveness of their subordinates is way below what it could be.

Supervisors, in this article, are those from the top levels down to the first line, and those whose functions are staff in type, as well as the members of the regular line organization. For an enterprise to operate efficiently, functions of both kinds must be headed up by able and enthusiastic individuals whose efforts complement one another.

Training is frequently resorted to as a means of correcting organizational ills but seldom are the desired results achieved. In extreme cases the development program backfires and leaves a bad taste in the supervisors' mouths.

To present the problem in its proper perspective, the dissatisfactions of top management will first be pointed out in this article, and then the supervisors' reactions to commonly used training methods will be described. Lastly, the situation will be presented from a consultant's view, based on his experiences in more than 200 companies from coast to coast.

As Management Sees It

Interest in the company's welfare decreases alarmingly from the top echelons down to the first line of supervision, thinks top management. The top men all give their energy, thought, and time to making the enterprise successful. The bottom men put in their time and go through the motions of working, but whether they work for one company or another is not a vital consideration. The men in-between vary in degree according to their respective management levels.

If everyone is to have the fervor of the president and vice president and reflect their industriousness, judgment, and loyalty to the com-

Mr. Bentzen has been training supervisors for many years, both as a company-based instructor and as a consultant. He is presently with Sunderlin Organization, management consultants headquartered in Cleveland.

pany, they must be motivated, given the tools, and taught how to use them. The logical answer, management believes, is a training program of some kind, and as those lowest on the totem pole are in greatest need they are the ones at whom it's directed.

Dr. Wolfgang Von Steinkraut, or his counterpart, is therefore called in to formulate and administer a suitable program. The eminent Ph. D. entertains his students and broadens their points of view. He does a highly competent job in a general way, but when it is all over the improvement is vague or, at best, unmeasurable. Neither top management nor bottom management is satisfied that specific needs have been filled.

As Foremen See It

"It was gratifying to know that the Company thinks enough of us to engage an instructor of Dr. Von Steinkraut's prominence," the supervisors agree.

"He was extremely personable, a mental giant, and an excellent teacher; he raised our sights.

"But what did we learn that could be put to everyday use? Why were we foremen the ones to be brain-washed and propagandized when we believe our superiors need improvement just as much?

"But, we are fed up with one-way training. Get out more production! Cut costs! Meet schedules! Prevent grievances! That's all we hear and it's high time someone did something to help instead of preaching more sermons."

As Consultant Sees It

Areas much in need of improvement are usually 1) sound but misunderstood policies, 2) unsound policies and practices which should be corrected, and 3) organizational defects. All three of these are responsibilities of management, and supervisory training is more or less futile if they are ignored. Resentment develops when constructive supervisory viewpoints are suppressed and needless barriers to smooth operation are not removed.

On the supervisory level these conditions are frequently found:

- Supervisors do not always understand the basic responsibilities of supervision. Let's say, for example, that a foreman is informed a certain order must be shipped the following day. He instructs his subordinate accordingly. When the order is not shipped and he is asked the reason, he replies, "I don't know. I told Joe to do it."
- Supervisors sometimes work so hard that they have little time to manage. They perform functions which should be taken care of by Production Planning. They do paperwork which should be done by a clerk. They make investigations which should be made by Industrial Engineering.
- Supervisors, their immediate superiors, and even some highly placed executives stress the welfare of their own departments and divisions to the detriment of the balance of the organization. A common illustration is the sales department that promises quicker than necessary delivery and by so doing causes extra setups in the factory.
- Supervisors are chosen for their reliable personal qualities and their skills as artisans instead of leadership qualities. In one factory we found two foremen who actually could not read.
- Supervisors are wisely selected but poorly indoctrinated. One day they are workers and literally the next day they are bosses.
- Training methods and practices are, of themselves, suspect in some cases. When a course is held on company premises during working hours the atmosphere is not properly conducive to training. Interruptions by men being called to the phone disturb continuity.
- Interest often diminishes after the half way point in the course is passed. By this time the supervisors have a good idea of what is to come and, except for being somewhat entertaining and a respite from the daily hum-drum, they find the course boring.
- Most courses are predicated on the assumption that one person can develop another. This, we have observed is impossible; the most that can be done is to create in the learner a desire for improvement and help him to help himself.
- When the instructor is an employee of the company he does not always have the respect of his students. Regardless of how well he is technically qualified, his feet of clay and the fact that his foibles

Economic Supervisory Development covers . . .

1. **Discovery of specific problems.**
2. **Development of solutions to these problems *by the supervisors themselves.***
3. **Appraisal of the competence and potential of each trainee.**
4. **Recommendation of corrective measures to management.**
5. **Development of tangible procedural improvements.**

Following these steps, and dealing only with supervisory training and development, ideas worth $100,000 in savings were proposed to the management of a medium-size manufacturing plant by the author and his "students."

are known can not help handicapping his efforts. He can not say, "Do as I say, not as I do."

Even superficial consideration of these three viewpoints—top management's, supervisory management's and the consultant's, discloses faults on top management's part as well as deficiencies on the lower eschelons and the fallacy of uni-lateral information flow. The remedy should correct these conditions and at the same time use time-tested methods to build a strong supervisory force.

Deduced Philosophy

Enthusiasm is created when a training course embraces problems currently confronting those being trained and offers specific solutions to those problems. It is desirable, therefore, that the course be tailored to fit the needs of each student. For a fundamental course to be so altered, it is necessary for the instructor to visit each trainee on the job and learn exactly what his job situation is and how his understanding of it compares with the facts. This concept demands that the instructor, in addition to being a capable teacher, have practical experience throughout the entire gamut of management and, preferably, in various types of industries.

To keep interest from flagging, the discourse within the classroom must be two-way with the leader doing progressively less of the talking until at the end of the course his voice is heard no more than 25% of the time. Answers should be developed by the members of the class as the instructor leads their minds toward predetermined but unidentified conclusions.

It is often difficult for a top executive to become intimately familiar with the frustrating conditions under which many supervisors work today because direct communication is blocked by the chain of command, and/or because information flowing upward to him is either withheld or distorted. Information flowing upward is erroneous or incomplete when a conscientious executive conceals unpleasant facts or the existence of problems which he cannot solve although he believes he can do so.

For a training program to bridge this gap, all information and reactions emanating from the training group should be available to the chief executive. When he can see top management through the eyes of those on the lower levels, he can either take steps to eradicate misguided conceptions or correct unsound policies and practices.

Company instituted training programs often receive poor acceptance because of this one way flow of information. The supervisors of large companies which have had extensive experience call it "brain washing and propaganda to get out more production."

Finally, if training is to be entirely practical it should return more than its cost, the same as any other tool of management. A training course that taps the ingenuity of the supervisors more than pays for itself in the form of improvements with tangible savings value. A suitable yardstick is two to one the first year after completely ignoring intangible betterments.

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Spray Gun Crashes Heat Barrier

Sprayed coatings are now in the high temperature bracket, thanks to the development of the plasma flame spraying method. The technique extends the range of materials which can be sprayed to include ceramics, and refractory metals such as molybdenum and tungsten. An easy-to-operate plasma flame spray gun, developed by Metallizing Engineering Co. Inc., uses an electric arc to heat gases up to 30,000° F, making possible the application of the high melting point materials.

Conventional methods of spraying metal on metal, using oxygen fuel gas equipment, have found wide applications in many industries for hard facing, and corrosion, abrasion, and thermal protection. The plasma flame method of applying these coatings results in higher density, with less oxide content and greater bond and tensile strengths. This is due to the greater velocity, higher temperatures, and more complete atmosphere control possible with the plasma flame. Cost of generating the plasma gas streams is one-third to one-half lower than with oxygen fuel gas for the same heat output.

In operation, nitrogen and 5% to 10% hydrogen are passed through the electric arc in the water cooled nozzle of the spray gun. The high temperatures cause the particles of the gas to become electrically dissociated. The powder to be melted and sprayed is then introduced through an external tube into the plasma flame and is sprayed onto the work. Despite the flame temperatures of 10,000° to 15,000°F normally used, the sprayed work stays cool.

Pushbutton operation of the gun makes it possible for the operator to safely and easily apply any material which can be melted without decomposing.

Grinding Thin Parts

Ways to get around the heat bugaboo that plagues thin-part grinding.

THE WORD "THIN" is a relative term which may actually cover a considerable range of different thicknesses. When surface grinding thin parts, even widths and lengths of given parts, or over-all area, or both, are often significant.

Most of the trouble involved in surface grinding thin flat pieces is due to heat build-up. An obvious way to reduce this is to reduce the amount of each cut per pass. Some work of this kind has been processed to good advantage on vertical multiple spindle units, so all stock is removed at a single pass through the machine, but the entire amount is divided between the number of spindles operating.

Reducing Contact Area

Another means of reducing heat build-up on thin stock is by reducing actual area of grinding wheel contact. In extreme cases this can be done by using a horizontal spindle grinder, where the periphery of the wheel is employed. Obviously, this reduces area of wheel contact, which may be even further reduced by taking lighter cuts.

Where work is not so exceedingly thin, segmental grinding chucks and vertical spindle machines are best because the openings between abrasive segments provide a certain amount of cooling action in their own right. Beyond this, they allow for more thorough influx of coolant so heat may be transferred more readily.

In some extreme cases, where exceedingly thin work is being ground, it's advisable to make uniformly-spaced oblique slots across the face of the periphery of a wheel. The reason for making such slots oblique instead of squarely across the wheel face is that oblique slots allow part of the wheel periphery to remain in contact with the work at all times. This eliminates vibration.

All slots may be made oblique across the face of the wheel in the same general direction, if desired. Some, however, prefer to reverse the direction of obliquity on alternating slots. Thus, four slots can be made across the face of the wheel periphery 90° apart, all oblique in the same direction. Then, four more slots may be made half-way between the first four but oblique in the reverse direction, making eight slots in all around the wheel periphery. Such slots should not be deep. They can be ground with an abrasive cutoff wheel. They introduce a certain amount of fanning action and provide for somewhat better influx of coolant between wheel and work.

Occasionally it is necessary to arrange for faster heat transfer by other methods. A case in point is where thin flat work has been held on a heavy copper plate for surface grinding. Copper has the characteristic of fast heat transfer. Where a relatively-heavy copper plate is used for holding thin flat work, such heat as penetrates through the work is carried away faster than it would be if held on a steel support. Special fixtures sometimes contain a copper plate.

One aspect of grinding both sides of relatively thin work while holding it on a magnetic chuck for grinding the first surface should be noted: The chuck may pull such work flat, where it may not be flat to begin with. Avoid this in the interest of final straightness and flatness. If a piece of work which is not flat on either side in the rough is subjected to the full pull of a magnetic chuck it will usually be pulled down flat. Then,

although the top surface will be ground perfectly flat while it is so held, it will not be flat when released but will spring back toward its original distorted form.

On some large surface grinders, therefore, the magnetic chucks may have additional equipment for reducing the pull of the chuck. This way a mild magnetic holding force is made available, but it is not powerful enough to spring a crooked piece flat on the chuck. Such work should be shimmed up at several points so it will lie naturally on the chuck or table while the first flat surface is ground. Then, when it is turned over for grinding the second surface, that surface will also be made flat and parallel with the first.

Another trouble sometimes experienced with thin flat work processed on a magnetic chuck, especially when the workpiece is of steel, is that it clings tenaciously to the chuck after the power is turned off. So, demagnetizers are used and the work practically floats on the chuck when released.

Where thin pieces are of very small area, or where specific dimensions of the work across which abrasive grains on the wheel pass are short, heat generation is greatly reduced. Workpieces of this type lend themselves to surface grinding with a vertical spindle grinder, using a segmental chuck or a cylindrical wheel. While the nature of such a wheel is to present considerable surface contact to perfectly flat workpieces of large area, the field of contact is greatly reduced and coolant application facilities tremendously increased where the path of abrasive grains across such workpieces is short.

An interesting instance in point is seen in the illustration. A Mattison vertical-spindle rotary grinder is used at Standard Tool & Manufacturing Co., Kearny, N.J., to finish small metal jaws used in the precision tools the firm makes. One hundred jaws are ground at a time.

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New Multi-Hole Punching System

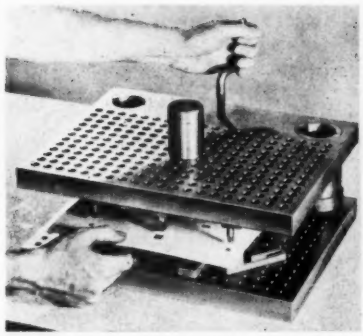


Fig. 1. Setting up the adjustable punches and dies outside the press.

A NEW SYSTEM OF adjustable punches and dies has been introduced by O'Neil-Irwin of Lake City, Minn. Although it can be used for long or short runs, the program's best time- and money-saving applications are in short run punching of multiple holes—it eliminates punching holes individually and having a permanent die made. All tooling is reuseable.

The basic elements in this Di-Acro program are specially designed die sets, on which punch and die holders can be arranged—by means of a template—into a variety of hole patterns. The "pegboard" hole pattern of the die sets is spaced on 3/4″ centers in both directions, which allows 100% overlapping and permits holes to be punched anywhere within the die set area. Additions or adjustments can be made to an existing setup in the press.

Material as thick as 16 ga mild steel and 1/8″ aluminum can be punched to ±0.005″ tolerances.

The versatility of the systems gives the setup man a choice either to set up away from the press or while the die set is in the press. Usually setup is made up outside the press because it's safer; there's no hazard from accidental tripping while the setup man is working. "Outside" setup is also faster because there's more work room, minimizing "knucklebusting" and difficult-to-make inside adjustments.

Circular locking grooves on the die buttons can be revolved 360° within the holder. When irregular shapes (other than round) are to be punched, this circular locking groove feature allows the die to be located radially with reference to the holder. Without this feature it would be necessary to rotate the die holders, and in some cases setup would be impossible because of interference between or among die holders.

Di-Acro adjustable punch and die sets are available in a back post type that requires 6 1/4″ minimum press shut height, or the center post type that requires 6-3/4″ minimum press shut height. Both styles are made of chrome alloy steel, ground concentrically, with ball bearing bushings providing negative clearance. Punches and dies of similar size are interchangeable.

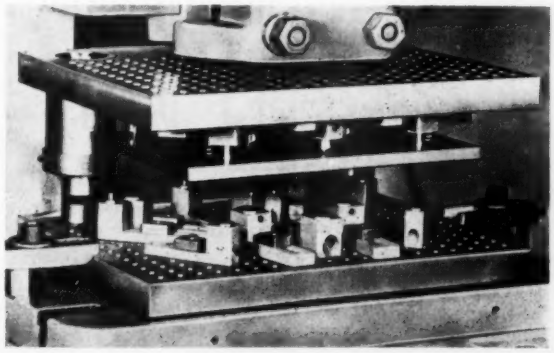


Fig. 2. Assembled adjustable punch and die set in the press.

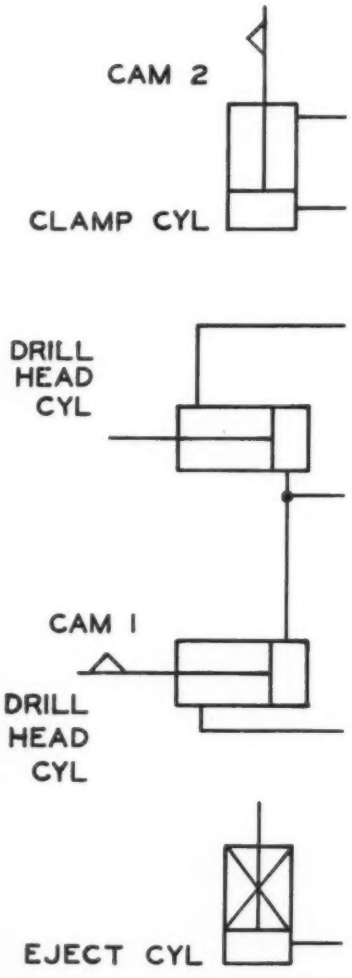
Expert or Beginner, try these . . .

Fill-in-the-Blanks

Proposition 1.

A double-acting cylinder is to clamp the work with a gentle approach, but firmly. After clamping, two drill-heads are to advance and return. When they return, work is unclamped and ejected. Initial action is triggered by operator; after that, cycle is automatic. In this application, hydraulic checks are not used, but some speed control is necessary to smooth out and synchronize the cycle. Here are a few hints as to components we use: For the master valve, we use a two-position four-way that's manually operated in one direction, and cam returned. For the clamp-drill return-unclamp sequences, pressure-operated valves are used. The ejection-cylinder receives its pressure through a two-position three-way valve. It's cam-actuated by a flip-flop finger carried on clamp-cylinder rod.

("Doodle" Space)



Turn to page 70 for Our Solution . . . Match it to this page.

Pneumatic Circuits

by William E. Hoffman
Engineering Editor

Here's your chance to work out some realistic air-powered problems and get a better understanding of pneumatic circuitry, to boot. If you get stumped, the Discussions on following pages will help "bail you out."

IF YOU KNOW pneumatics and JIC symbols, read the Propositions and complete the diagrams in the "doodle" space provided. Check your diagrams by matching them with ours, on the pages indicated. Read the Discussions of the Propositions if you have any questions.

IF YOU DON'T KNOW pneumatics as well as you'd like, read the Discussions **before** completing the diagrams. Then match your completed diagrams with ours. If there are any questions, a second reading of the Discussions should clear things up — or, drop us a letter and we'll analyze your questions for you.

Reference Material

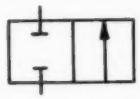
• **A three-way valve** has three ports; an inlet, a port to cylinder, and a port to atmosphere. Usually it's a two-position valve.

• **The four-way valve** has four ports; an inlet, two ports to a cylinder and one to atmosphere. They are two- or three-position valves. For example, a three-position valve might have all parts blocked in its center position — or other combinations.

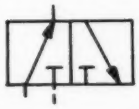
• **A sequence valve** is like a check valve in that it opens at a predetermined pressure setting. When open, it passes air to the next cylinder down the line. Understanding this is easy if you remember there's no pressure in a line until it's closed or restricted. So, when a cylinder is moving, the line pressure to it is only as great as the resistance-force offered by the cylinder. At the end of its stroke, line pressure then becomes as great as that exerted by the compressor. As this takes place, the sequence valve opens and allows air to second cylinder, etc.

• **Flow control (speed control) valves** operate on a metering principle. Usually they have full flow in one direction and are restricted in the other; restriction may be variable or fixed.

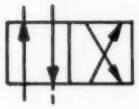
The JIC symbols you will find in the completed circuits and need to complete those circuits which are incomplete:



Shut-off Valve
Two-way
(2-port)

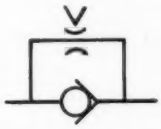


Three-Way Valve
(3-port)



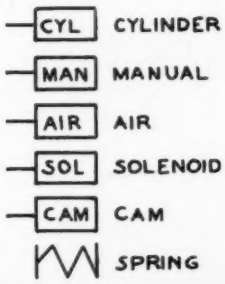
Four-Way Valve
(4-port)
(2-position)

Sequence Valve



Flow Control Valve

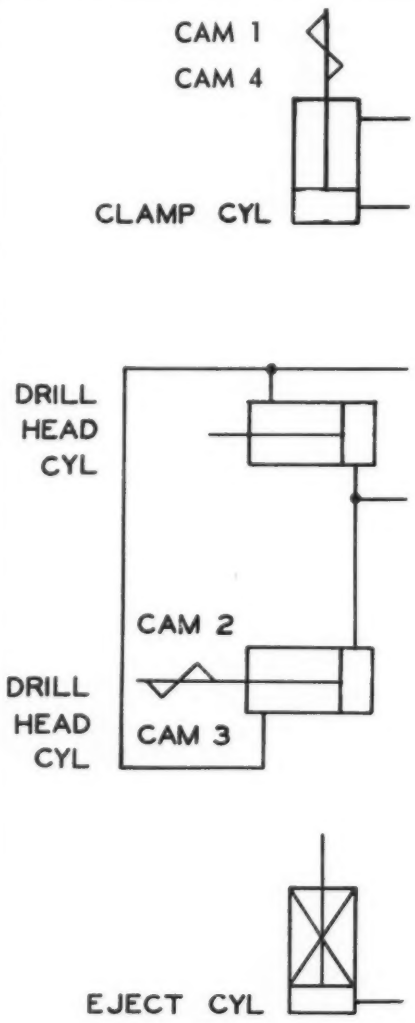
To indicate the manner in which the valve is actuated: Attach the proper rectangle, by its tail, to the valve symbol.



Proposition 2.

A double-acting cylinder is to clamp the work with gentle approach, but firmly. After clamping, two drill heads are to advance and return. When they return, work is unclamped and ejected. Initial action is triggered by operator; after that cycle is automatic. In this application, hydraulic checks **will** be necessary to smooth out the drill-feed part of the cycle; some speed control valves are also to be included for synchronizing. The components we use are: A two-position four-way valve for clamping, and another one for control of drill head cylinders. Both valves are pilot-operated by bleed to atmosphere. A manual two-position three-way pilot valve with spring return starts the action. Sequencing is accomplished by cam actuated pilot valves of the same type. As in Proposition 1, ejection pressure comes through a two-position three-way cam-operated valve.

("Doodle" Space)



Turn to page 72 for Our Solution . . . Match it to this page.

PUSH-BUTTON SELECTION *of 24 spindle speeds, throughout 16 to 1600 rpm range (18 to 1800 rpm for No. 210-12 Dial Types).*

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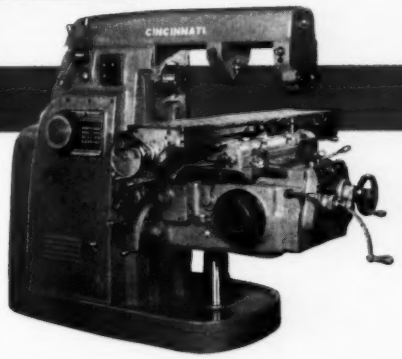
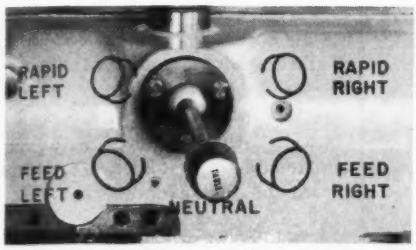
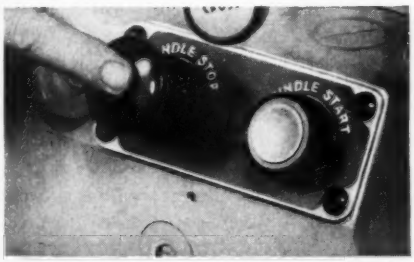
. . . for Dial Type Operators





FIVE-POSITION LEVER *gives the operator complete one-hand control of table (automatic cycle machines).*



PUSH-BUTTON STARTING AND STOPPING *of spindle rotation. The operator gets quick action and automatic braking.*

POWER SELECTION OF 32 FEEDS, *ranging from ⅜ to 90 ipm. Feed selection knobs located at front and rear positions.*

Ask the man who runs one. He'll tell you that CINCINNATI Dial Types are easy to operate and set up, and they help him maintain high quality . . . important considerations in low cost of production. Five outstanding feature-advantages are illustrated here. Others include: • Automatic backlash eliminator for milling to the right or left • Independent directional control levers, with palm-fitting plastic knobs • Identification discs on all control lever knobs • Dynapoise chatter-damping overarm, automatically damps out chatter and improves finish on the work • Complete rear controls (plain and universal styles).

Operators, foremen, top management . . . all prefer CINCINNATI Dial Type Milling Machines. More information is in comprehensive catalog No. M-2003. And our replacement Analysis Manual No. M-1838 will guide you in replacing your old milling machines. Write for copies today. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

ARBOR-LOC SPINDLE NOSE *helps operator change cutters safely and quickly (20 seconds or less).*

CIRCLE INFORM-A-GRAM KEY NO. 69

E TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES
CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI

MILLING MACHINE DIVISION

Discussion of Proposition 1.

Our circuit-diagram shows all component symbols when circuit is in static position: Clamp-cylinder is retracted, drill-head cylinders are retracted, and the eject-cylinder is retracted. All valves are shown in their respective positions to have caused this.

The workpiece in this instance is fragile, which accounts for the use of speed control valves to slow clamp-cylinder. Speed control of clamp-cylinder return is optional; maybe of value in synchronizing.

Initial cycle start is by a manual shift of the four-way valve, putting the right-hand symbol-block into porting position. Pressure goes to the piston end of the clamp cylinder, and air is exhausted from the rod end through the check-valve portion of the sequence valve. When work is clamped, pressure builds up back through the line, overcoming the sequence valve setting, opening it. This permits line pressure to flow to the piston ends of the drill head cylinders, and they are extended.

Although the holes to be drilled have little depth and don't break through, drill head speed must be controlled. We show three control valves on drill heads for synchronizing. It would be well to consider using four — two metering valves for each cylinder, rather than joining piston end lines into one control valve.

The exhaust of all three cylinders is piped back through the four-way to atmosphere on both "stroke" and "return."

At the end of the drill stroke, a cam shifts the four-way, to reverse the action. However, it is necessary to return the drill heads before unclamping, which is accomplished by the proper positioning of the second sequence valve that works like the other one. With the left-hand block of four-way symbol now in control, pressure first goes to the rod ends of the drill head cylinders. At end of the return stroke, pressure build-up overcomes the sequence valve spring and the clamp cylinder receives pressure to the rod end, returning it.

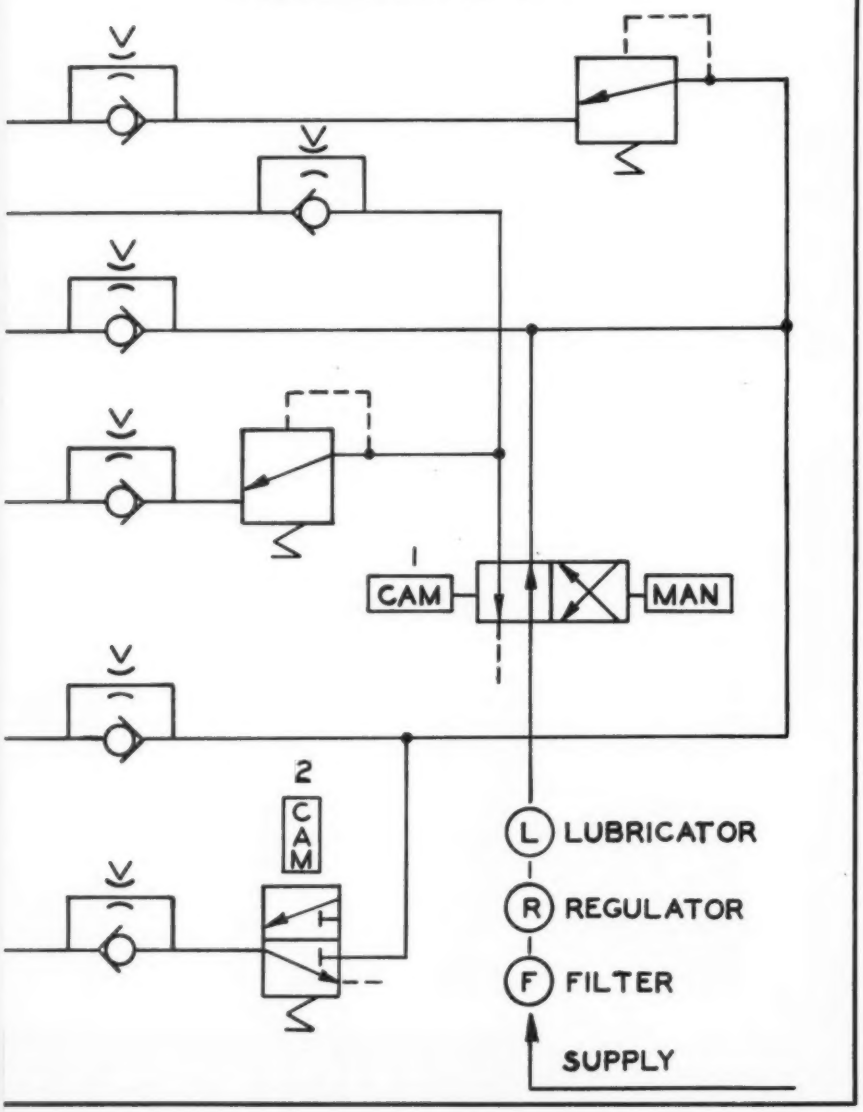
As the clamp cylinder approaches the end of its return stroke, Cam 2 shifts the two-position three-way valve, porting pressure to the eject-cylinder. Ejection takes place and the three-way is spring returned to allow air to atmosphere from the piston end of this cylinder. The eject cylinder returns to complete the cycle.

Speed control valves for the ejection cylinders are suggested, but optional. You will note that speed of ejection is by controlling the flow of air in the inlet piping. This would be more effective in the exhaust line, but since the ejection cylinder is single-action, this is not possible.

Where sequence valves are used, adequate pressure must be promised the system. The designer can't foresee that the pressure may be "allowed to" fluctuate below spring setting or that dirt may be "allowed in," to "hang up" the valve. So he should design individually for each set of conditions. For instance, where a malfunction **can't** cause a critical situation, like endangering life, limb, or expensive work, sequence valves may be the answer.

Although additional four-way valves could have been used in place of sequence valves, they are more expensive and require more piping. **Discussion 2, page 72**

Our Solution to Proposition 1.



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8111

CIRCLE INFORM-A-GRAM KEY NO. 71

Discussion of Proposition 2.

As in Proposition 1, our diagram shows circuit components static; no action taking place.

In this instance the workpiece is not fragile, but to save wear and tear on equipment and cut down noise, speed control valves are used for clamp-cylinder.

Cycle-start is by a manual shift of the two-position three-way pilot valve. The pilot valve bleeds air to atmosphere from the four-way clamp-cylinder control valve, to shift it. Pressure for shift comes through another three - way already open to line pressure. Pressure goes through the four-way to the piston end of the clamp-cylinder, extending it.

As the clamp-cylinder approaches the end of its stroke, a flip-flop finger (Cam 1) shifts the pilot three-way (see Cam 1 indication). Air pressure is bled from the left side of the drill head control valve, to shift it. Pressure for the shift comes through the pilot control valve connected to other end. Pressure through the four-way to the piston end of the drill head cylinders drives them into the work.

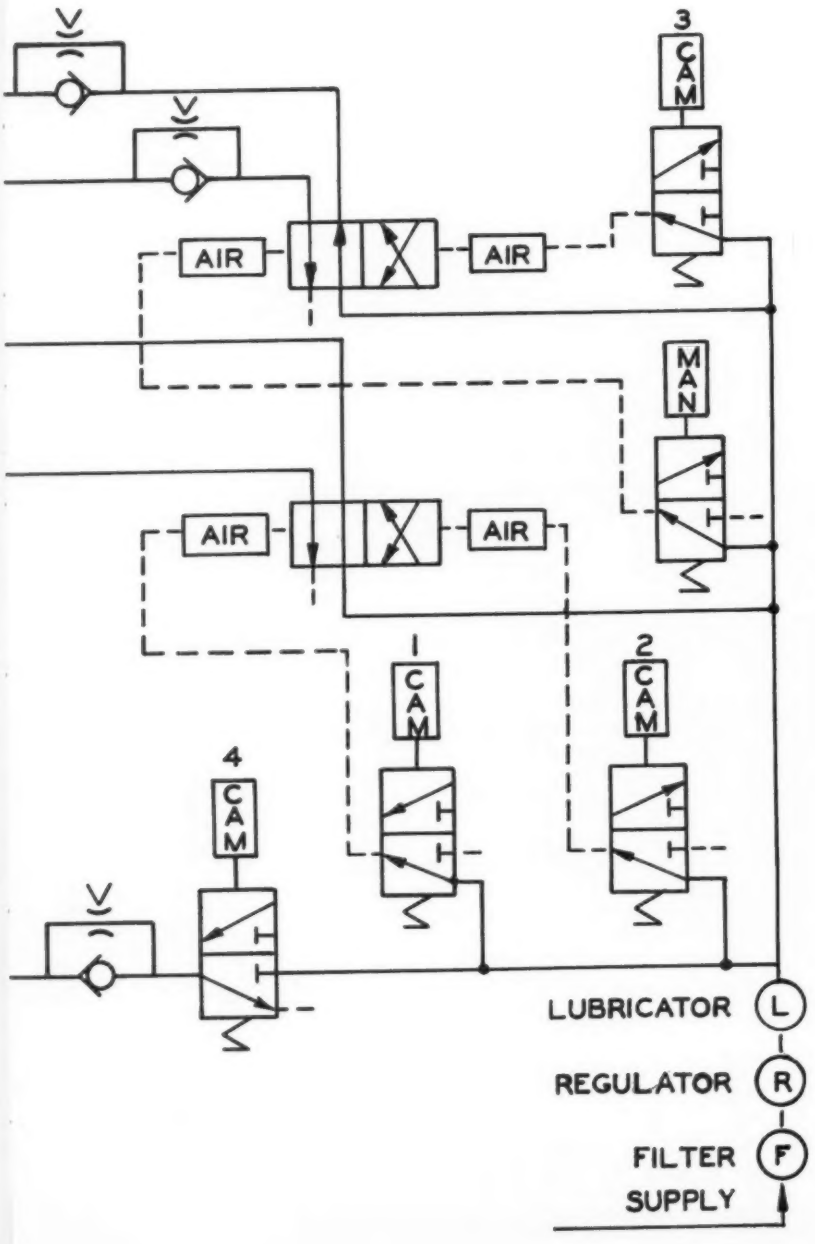
This workpiece requires holes of some depth, and there's the possibility of "hard spots," so hydraulic checks should be used, although they are not diagrammed. As you know, these meter oil from one side of a closed system to the other. Liquid metering and non-compressibility are the advantages.

At the end of the stroke, drill cylinder Cam 2 bleeds still another three-way to shift the drill head control valve for the return of the drill heads. On their return stroke, Cam 3 opens the pilot valve to shift the clamp-cylinder control valve to unclamp. Near the end of its un-clamp stroke, Cam 4 opens the three-way ejection cylinder control valve for ejection.

Since the Cam 4 finger is the flip-flop type, the ejection cylinder control valve is only open long enough for ejection. It then closes off line pressure. In its other position it bleeds air from piston end of the ejection-cylinder, which returns by spring pressure.

Although we give no consideration to valve sizing, it should be noted that all three-way valves are pilot valves, with the exception of the ejection control valve. It must be sized properly to handle adequate pressure and flow.

Our Solution to Proposition 2.



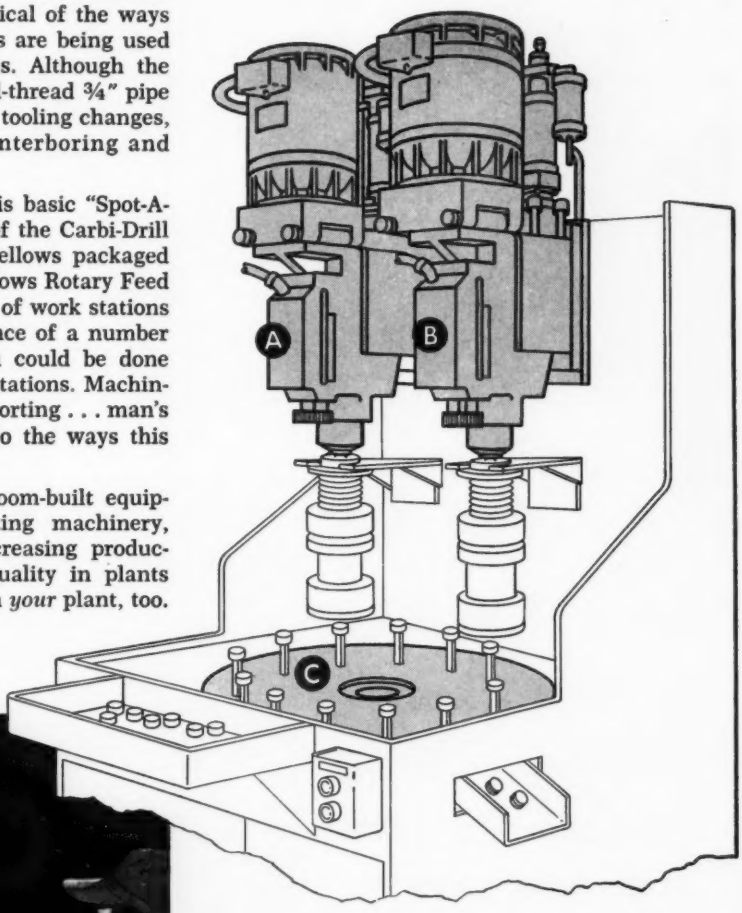
Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Rd., Cleveland 18.

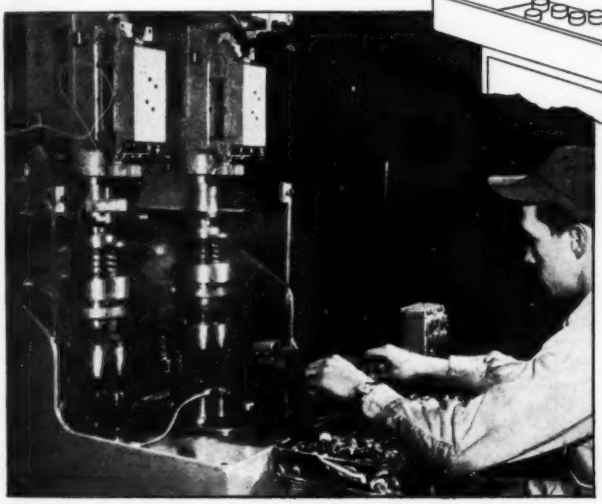
CHANCES ARE YOU CAN USE THIS "SPOT-A-MATION" IDEA TO CUT YOUR COSTS

Simple, inexpensive and easily built in the user's own shop, this "Spot-A-Mation" Idea is typical of the ways Bellows "Controlled-Air-Power" devices are being used to cut costs in all types of industries. Although the machine illustrated here is used to roll-thread ¾" pipe plugs, this same unit, with only minor tooling changes, can perform drilling, tapping, counterboring and similar operations.

Think of the many possibilities in this basic "Spot-A-Mation" Idea. For example, in place of the Carbi-Drill units, Bellows Air Motors or other Bellows packaged work units could be used with the Bellows Rotary Feed Table. On the work table, the number of work stations could be increased to permit a sequence of a number of operations, or the same operation could be done simultaneously at a number of work stations. Machining, forming, assembling, packaging, sorting . . . man's ingenuity is virtually the only limit to the ways this "Spot-A-Mation" Idea can be used.

Both as the basis for low cost, toolroom-built equipment and in spot-automating existing machinery, Bellows "Controlled-Air-Power" is increasing production per man-hour and improving quality in plants throughout the world. It will pay off in *your* plant, too.





Essentially, this machine consists of two heavy duty Bellows Carbi-Drill units, "A" and "B", equipped with roll thread heads and synchronized with a Bellows Rotary Feed Table, "C", which positions work pieces. Operation is continuous and automatic. Operator merely feeds; parts are ejected automatically. Production is double that of former equipment, less skilled operators are used and rejects have been virtually eliminated.

THIS SPOT-A-MATION IDEA FILE IS YOURS ON REQUEST

Contains complete information on the above "Spot-A-Mation" Idea so that you can adapt the Bellows Rotary Feed Table with Carbi-Drill units or other Bellows packaged work units for use in your own plant, plus installation data, wiring diagrams and equipment lists for scores of other Bellows "Controlled-Air-Power" applications. Write for yours today. Address Dept. TP-360, The Bellows Co., Akron 9, Ohio.

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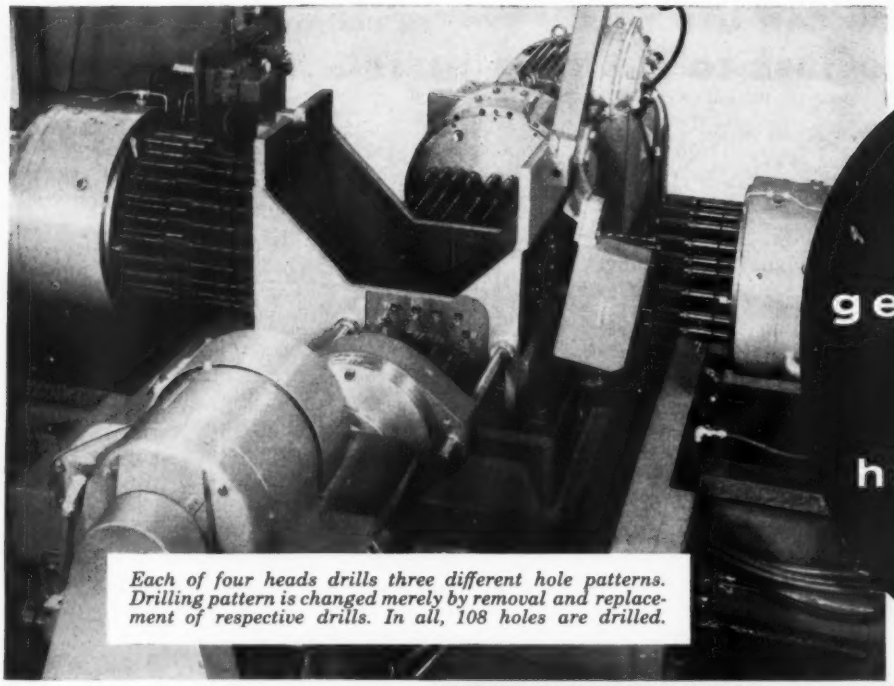
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

AKRON 9, OHIO

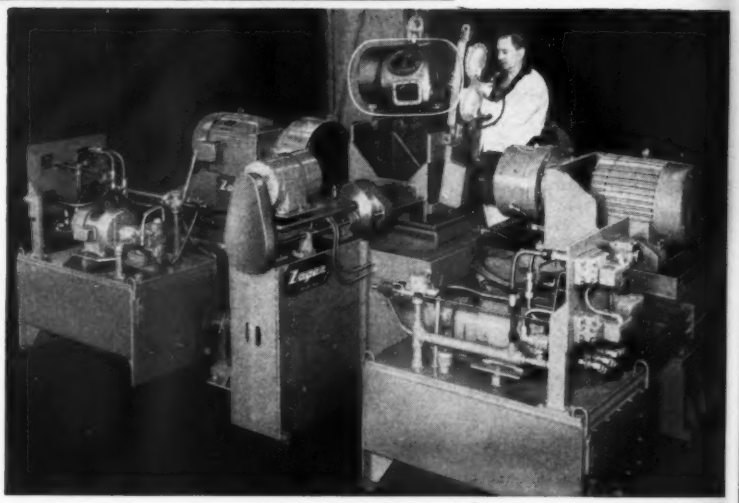
CIRCLE INFORM-A-GRAM KEY NO. 73



why gearless drill heads?

Each of four heads drills three different hole patterns. Drilling pattern is changed merely by removal and replacement of respective drills. In all, 108 holes are drilled.

because Zagar *gearless design can use more spindles and do more work*



Zagar gearless design in multiple spindle machining permits a flexibility unmatched by any other equipment. Basically, the application of more and still more spindles is the key to savings in every stage of the job. From incipient engineering through cost per part (or cost per hole), every step is marked by cost-saving over any other approach. As spindles are added, cost per spindle actually decreases. This advantage obtains whether the head is designed to produce one part or more than one part of varying machining patterns.

When drilling, reaming and tapping on more than one part, Zagar can often apply one head to do several patterns. Zagar heads drill, ream, and tap varying diameters on any center.

Write for Engineering Manual A-2 for technical reference.

Zagar INCORPORATED

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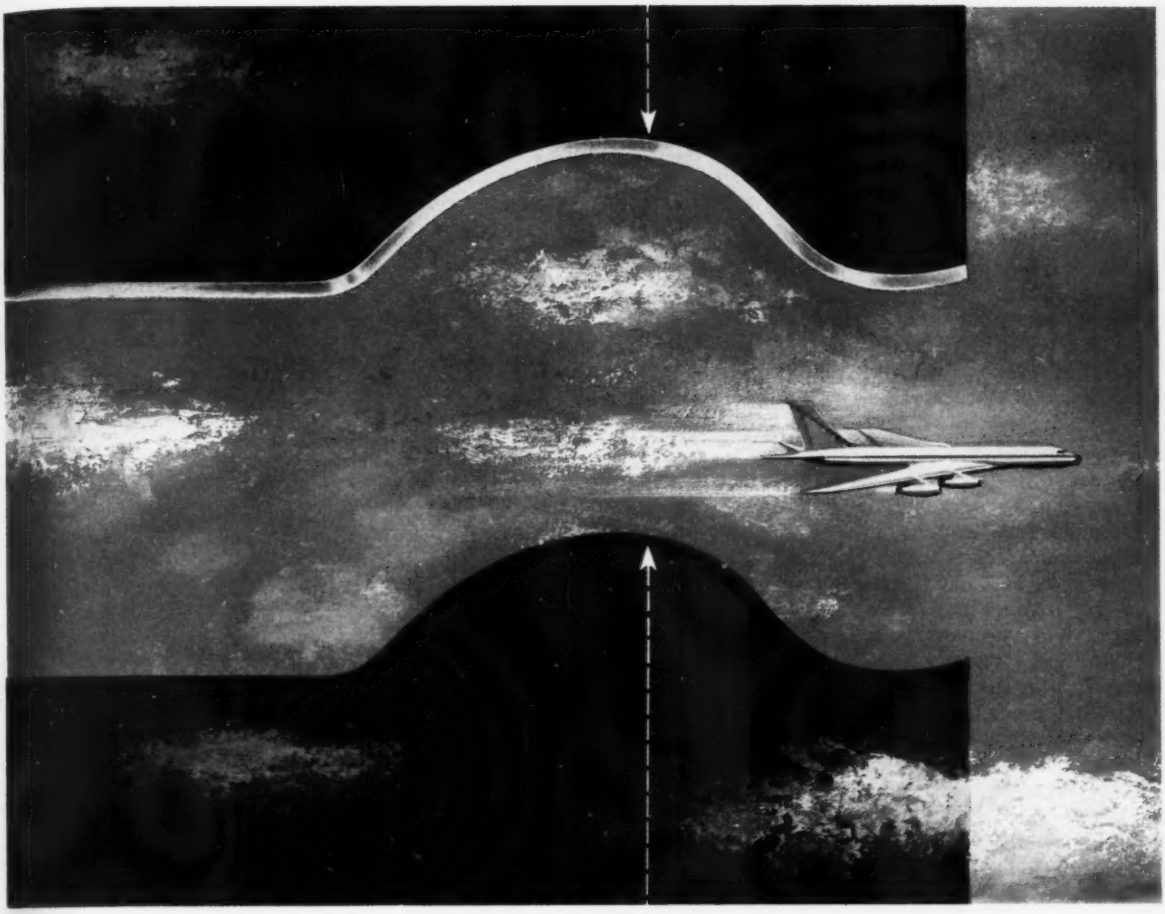
USE MORE SPINDLES TO DO MORE WORK

CIRCLE INFORM-A-GRAM KEY NO. 74



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CIRCLE INFORM-A-GRAM KEY NO. 75

'Brush-On' Plating's Versatile

DALIC IS AN ELECTROLYTIC process for selective plating that doesn't require submerging the work. Instead, the solution is carried on a cotton and dacron covered graphite tool of appropriate shape. When the proper current flows from the tool to the work, plating takes place. There are 23 metallic solutions with which the tool may be saturated; each imparts a plate of the metal in solution.

I sat in on the disclosure of the process to the press, at Sifco Metachemical Inc., a division of The Steel Improvement and Forge Co., Cleveland, and found that plating in this manner has many advantages. Work preparation isn't time consuming. When selected areas are to be plated, stop-lacquers or masking procedures aren't necessary. This in itself is a great saving, and many jobs that took hours to prepare are now prepared in seconds.

The size of the work is of little consequence since no tanks are used and, by the same token, cleaning and rinsing tanks are no longer necessary, which eliminates the contamination hazard. Besides saving the tank cost, only small amounts of solution are needed to keep the tool wet — even the run-off is reclaimed in a catch-basin.

Fig. 1. Precision fitting of a cast steel flywheel to a drive shaft is achieved by Dalic plating. A flash of nickel followed by copper plating gives a 0.0025″ build-up, permitting the proper fit. No masking or immersion is required; fitting took less than 1-hr.

Fig. 2. Contact tabs of a printed circuit receive a 0.000050″ plating of gold the Dalic plating way. If this job were handled by other procedures, it would be necessary to dismount all components from the circuit board and then reassemble after plating.

It's still necessary to clean the work. However, this is easily done with a cleaning solution applied in the same manner as plating, only with a separate tool. After cleaning, the workpiece is water-rinsed and ready to plate.

Rate of deposition depends to some extent on the workpiece, but it's chiefly governed by the rate of dissociation of each particular solution. Chrome plating, for example, is "laid on" at a rate of 0.0003″/half hr; whereas a cadmium plate goes on much faster, at a rate of 0.0001″/min.

Plating in this manner offers an unusually fine grain structure having excellent low stress adhesion. The plate "laid down" by Dalic is hard and takes unusual abuse without peeling or flaking.

Dalic plating is used for repair work, such as in-place plating of molds or dies. A large rubber mold was recently given a 0.010″ to 0.020″ nickel-cobalt plating. It can also be used to build-up huge engine parts, for example, without their removal from ocean-going vessels. The other extreme might be IBM's Dalic plating of transistor heads, where the areas to be plated are only 0.001 sq in to 0.003 sq in. In this case, the plate thickness is controlled to ±0.000020″.

Other uses include building up under-size work; selectively stopping off of particular areas prior to carburizing or nitriding; and precision fitting bearings to extremely close tolerances. —WEH

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T&P Previews The Tool Show
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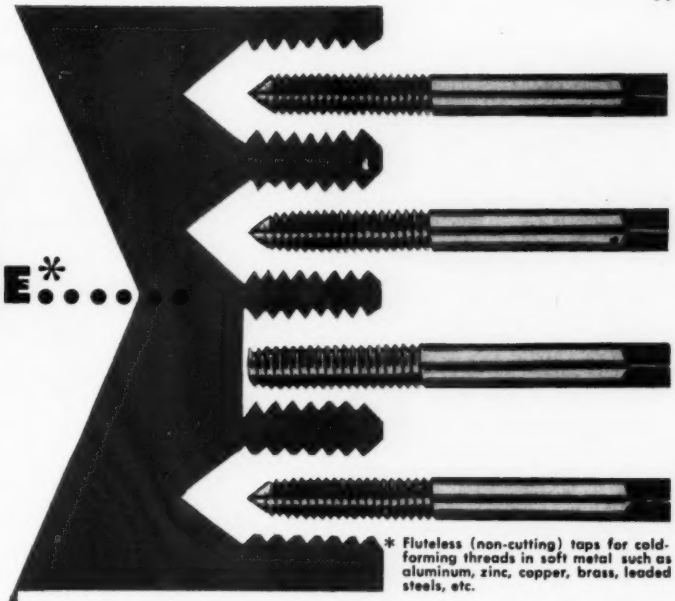
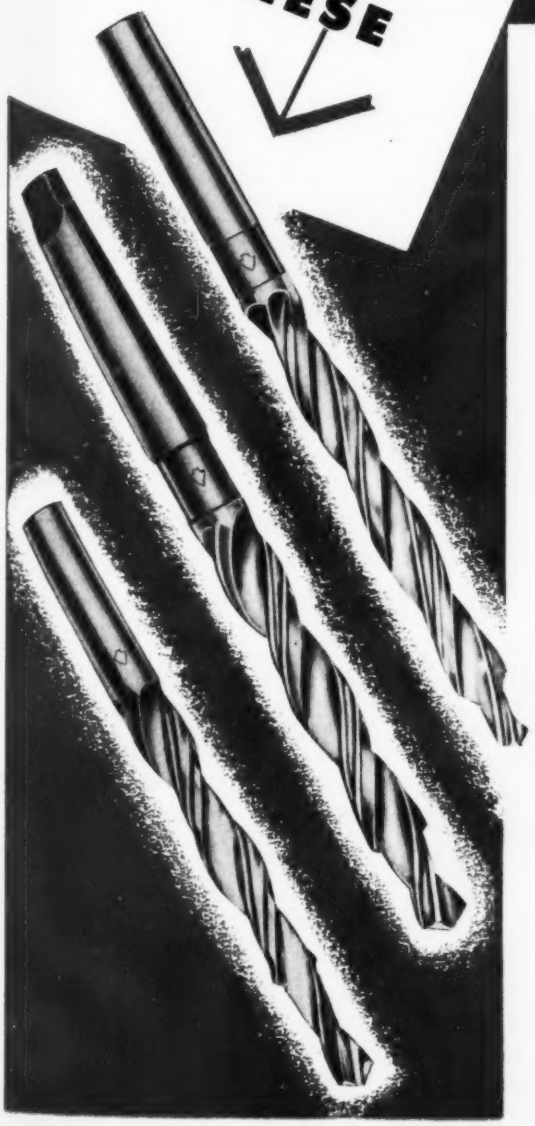
BY USING THESE



* Fluteless (non-cutting) taps for cold-forming threads in soft metal such as aluminum, zinc, copper, brass, leaded steels, etc.



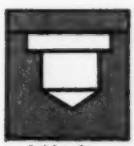
MOHAWK STANDARD SUBLAND DRILLS

If you are now using the popular new fluteless (non-cutting) tapping principle for softer metals, you can further improve and simplify your tapping operations through the use of Mohawk Standard Drill-Chamfer sublands. Mohawk drill-chamfer "standards" will simultaneously drill and chamfer clean, concentric holes that will speed your basic tapping operation, eliminate breakage and scrap, reduce your drilling tool inventories, eliminate jig and fixture movement.

If you are interested in drilling tools that really pay for themselves, examine your drilling and tapping costs, then see for yourself how many places a Mohawk "standard" could easily improve the job and reduce your costs.

AVAILABLE FROM STOCK—Mohawk "standards" are immediately available in all practical sizes, types and combinations in choice of 3 step lengths and 3 shank styles.

Subland Drill-Chamfer for Regular Taps Fluteless Taps Pipe Taps Heli-Coil Taps



Subland Drill Counterbore for Socket Head Cap Screws

Subland Drill-Drill for Tap Drill and Body Clearance

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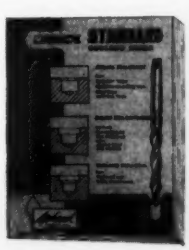

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George Huebner Gets SAE Buckendale Award

The Buckendale Award, one of the top national awards of the Society of Automotive Engineers, was presented to George J. Huebner, executive engineer-research for Chrysler Corporation, during the SAE's annual meeting in Detroit last month.

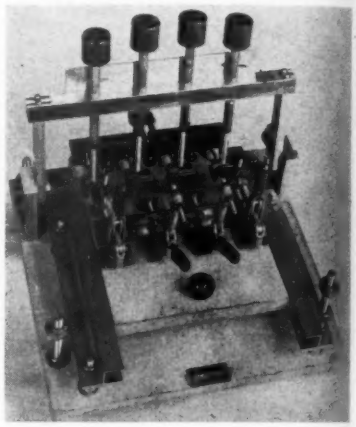
The award is given each year for the annual lecture by automotive management with distinguished authority in the technical areas of commercial and military ground vehicles. An SAE committee selected Mr. Huebner to deliver the lecture, which had to be "directed to meet the needs of young engineers and students and to provide them with up-to-date practical knowledge." Title of the award lecture was "Computer-based Selection of Balanced-life Automotive Gears."

Chrysler Vice President Harry E. Chesebrough, general manager of Plymouth-DeSoto-Valiant division, took over as SAE president for 1960 during the same week-long annual meeting.

Production Line Carbide Brazing

Four tungsten carbide cutter inserts are brazed to tool shanks simultaneously in about 18 sec, using the induction heating setup developed by Induction Heating Corp. This is done at a cost of 7½¢ for fuel, and on a machine that the "least skilled man in the plant can operate."

The fixture is used in conjunction with a 7½-kw Ther-Monic generator. Its operation is simple and fast. First, all toggle clamp handles are pushed down; then all pressure rods are lifted up and into the holding slots at the top by turning them 90°. The sliding carriage is then ready for loading.



The shanks and carbide blanks are assembled with brazing alloy, fluxed, and placed into the grooves of the carriage. Toggle clamp handles are then pushed forward and up, into locking position, to hold the shanks securely in place. Pushing the carriage forward to its stop brings the tip end directly into work-coil position.

Four pressure pins, one for each blank, are used to hold the tip in position while heating. A single push of the heat-cycle start button, located on the generator panel, begins the automatic cycle.

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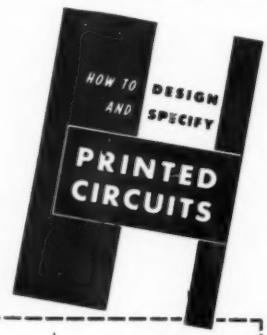

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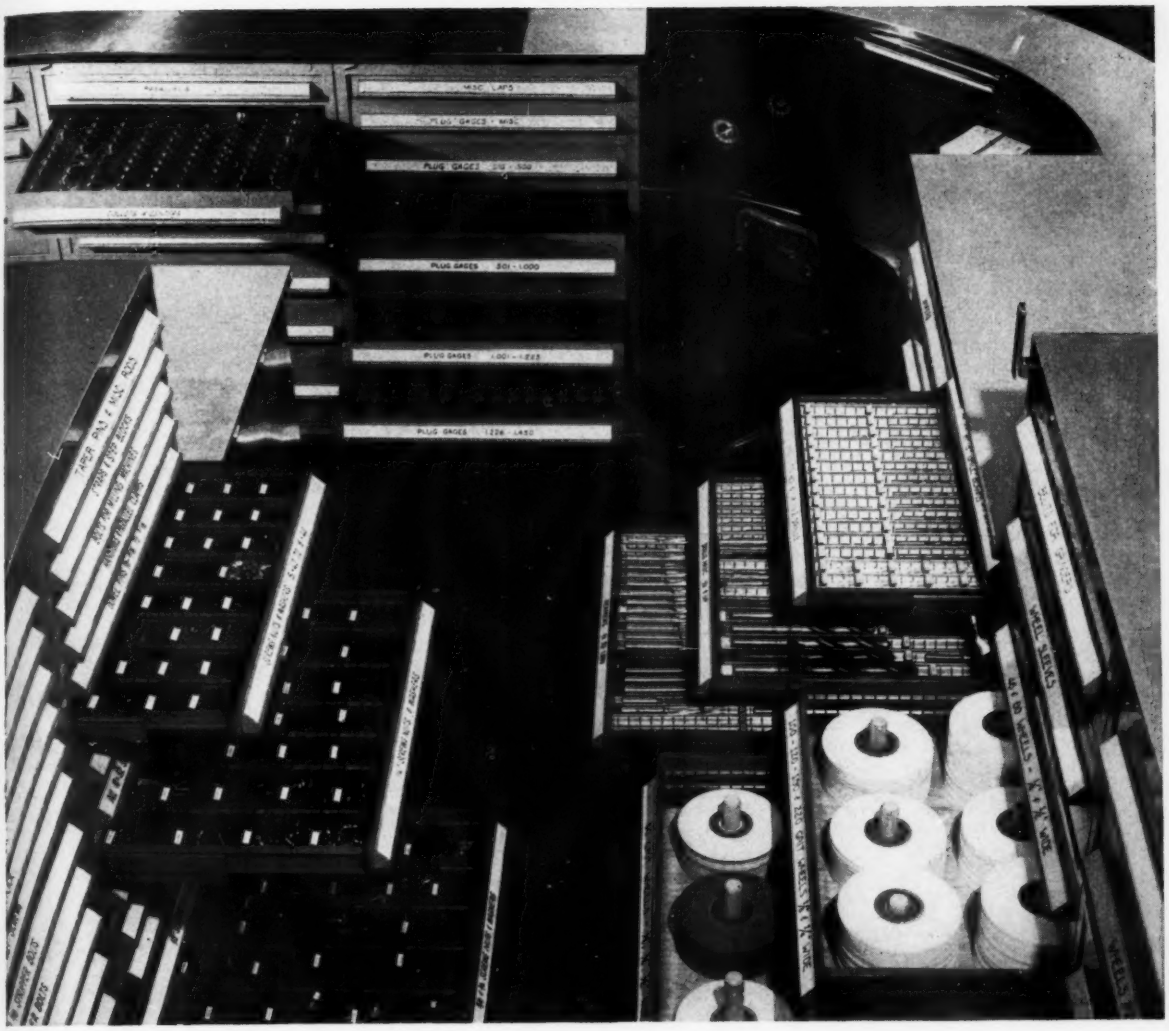

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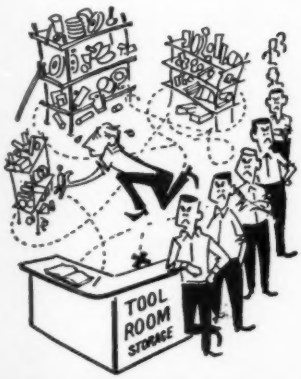

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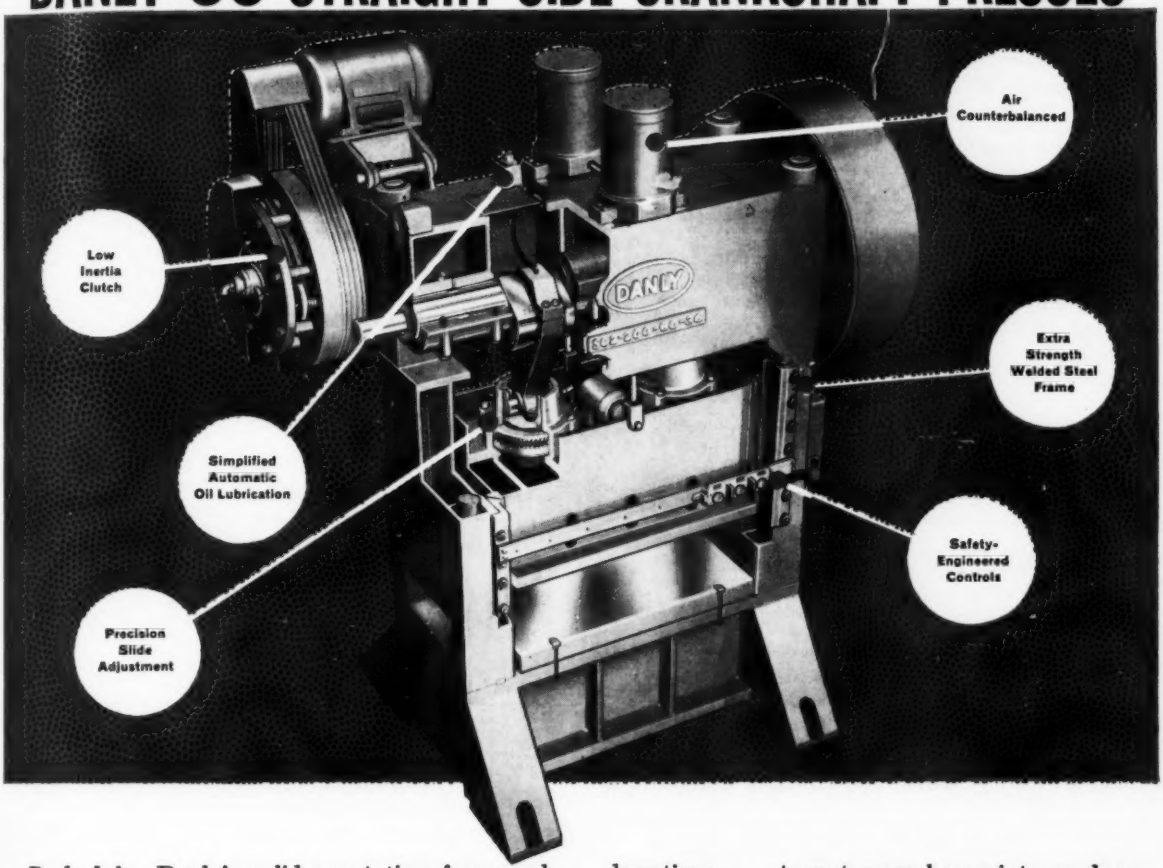

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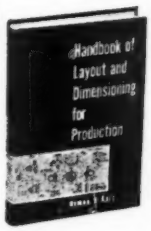

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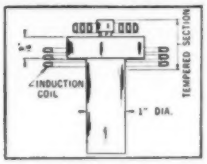

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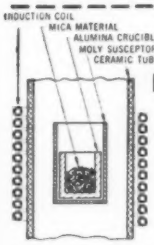

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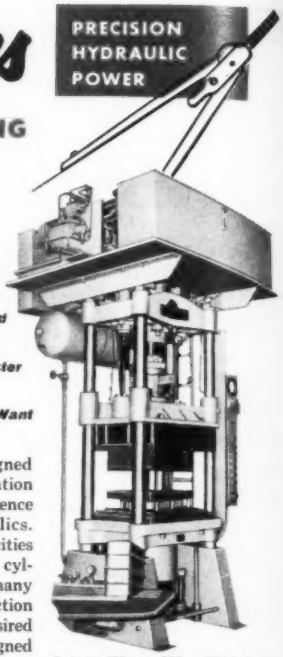

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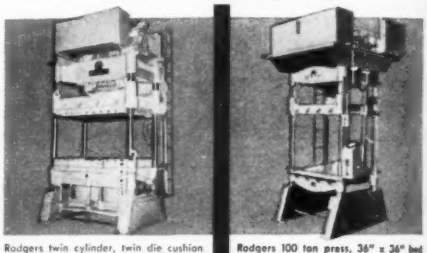

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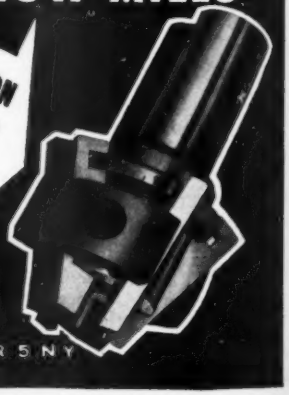

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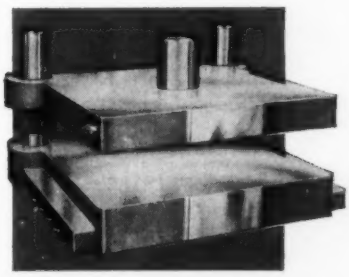

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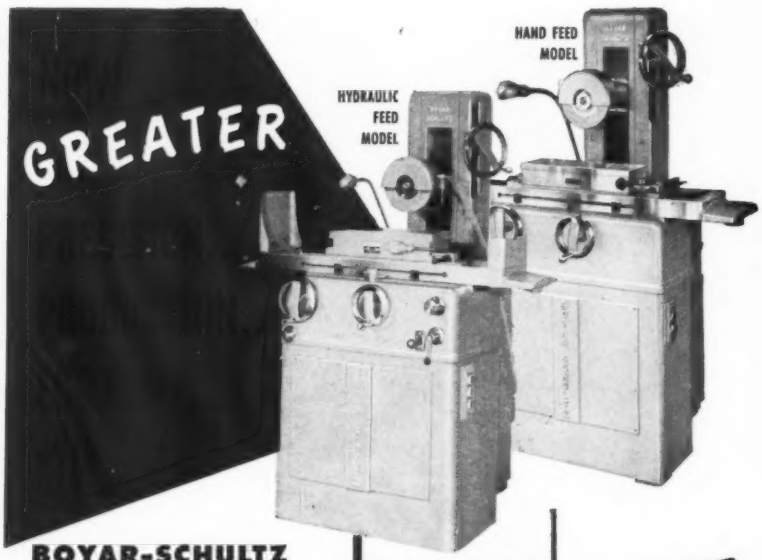

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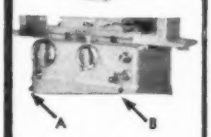

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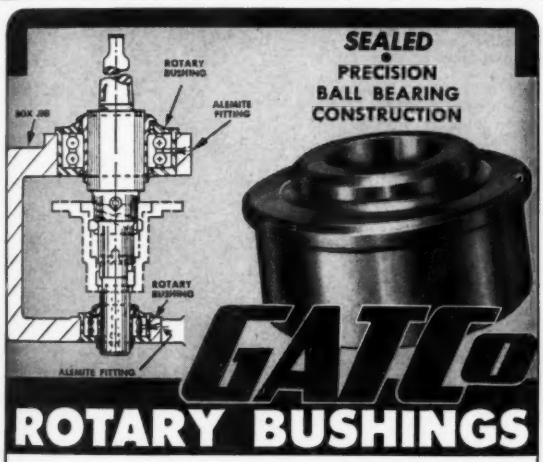

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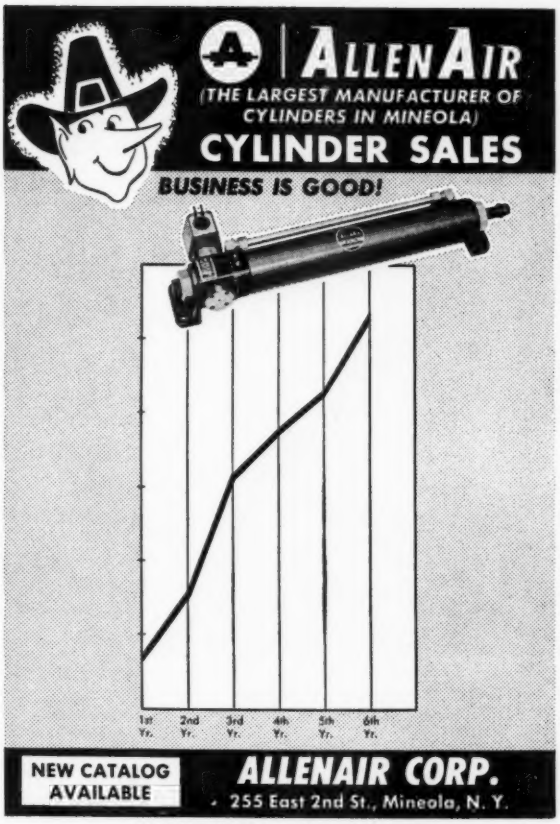

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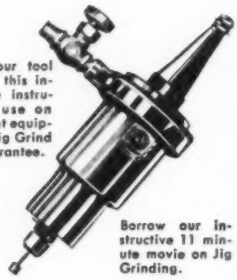

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NATIONAL ELECTRIC INSTRUMENT DIVISION
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Power Accuracy and Price

Photograph (actual size) of chip cut on R Series 15" Sheldon lathe. Depth of cut .250", Feed .016", Spindle Speed 400 r.p.m., Steel B-1112, Dia. of Work Piece 3".

"Free Running" spindle (Patent Pending) has no drive pressures to cause deflection. (See cut-out below.)

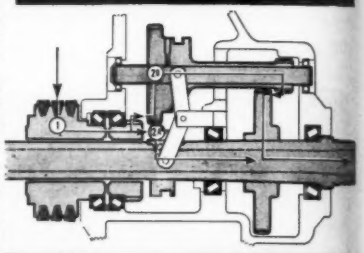
SHELDON
R-Series 15" Precision Lathes

Revolutionary in concept and design, these lathes deliver extra power and accuracy to the spindle nose.

Power is transmitted through 3 steel cable V-belts to the headstock input pulley assembly. (1) It is held free from the spindle by its own large tapered roller bearings. The input (1) assembly, then, absorbs all the drive pressures and transmits power to the free running spindle through a clutch (2A) in direct drive or gears (2B) in back gear drive.

This design (Patent Pending) eliminates spindle deflection resulting from drive pressures and leaves the spindle free for accurate work holding. Spindle nose runout is .0003" or less.

Other features include large 1⅛" hole through spindle . . . 60 pitch gear box with built-in lead screw reverse lever . . . apron that runs in oil and has independent drop lever clutches for power feeds . . . cam action tailstock clamp for rapid locking and instant release.



Write for bulletin and sample accuracy test sheet.

SHELDON MACHINE CO., INC.
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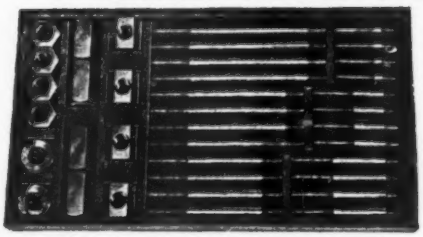

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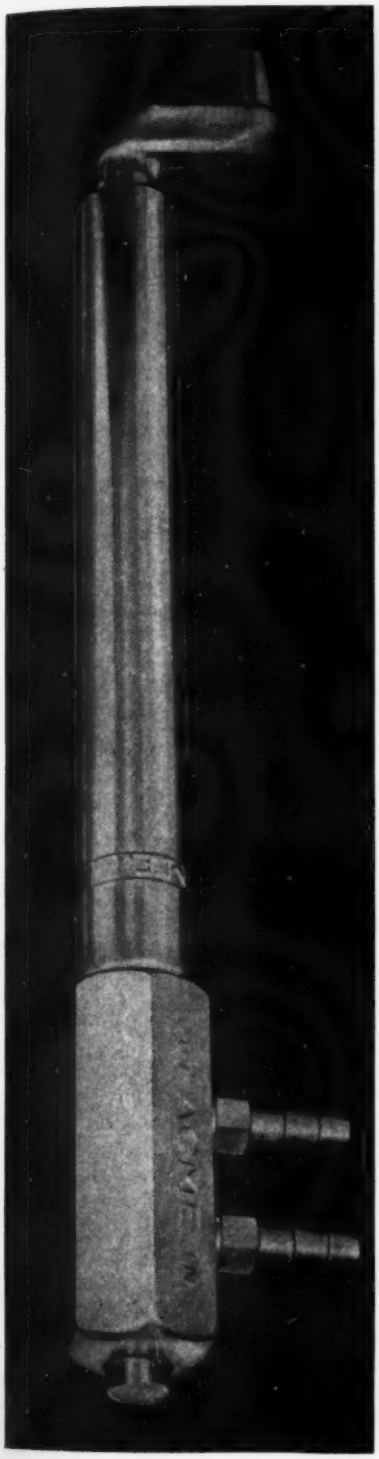

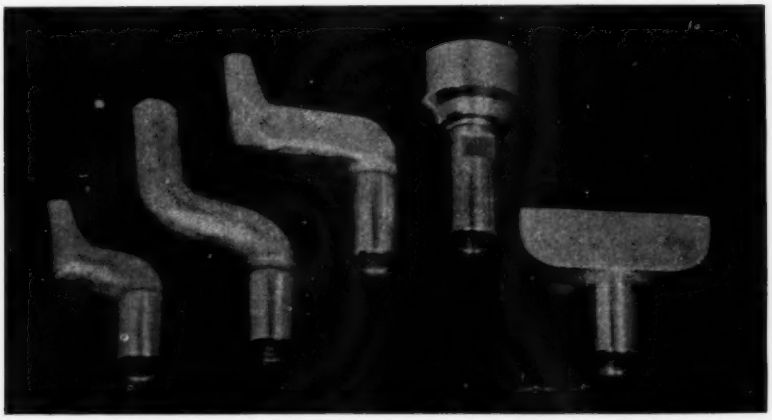

Acme Electric Welder Co., Los Angeles, a leading resistance welding equipment manufacturer, produces standard spot-welding tips from Chromium Copper-999 rod, seam-welding wheels from Chromium Copper-999 sheet. Irregular shaped tips, above, are Anaconda die-pressed forgings of Chromium Copper. In pieces fabricated from rod, bar, or sheet, strength and hardness are increased by cold working after heat treatment. Anaconda gives forgings an additional cold strike after hot forging to increase surface hardness. *Left:* A forged welding tip in an Acme water-cooled tip holder.

In resistance welding the electrodes must carry heavy currents under high pressures and at elevated temperatures. They must be made of materials that have high electrical and thermal conductivities and mechanical properties that will keep deformation and wear to a minimum. The widespread and growing use of resistance welding has stimulated research to meet the demand for more efficient and durable electrode materials.

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Anaconda also offers Hitenso®-961 as a more economical electrode material for use where service conditions are not severe enough to require the higher properties of Chromium Copper-999. Its properties exceed those of RWMA Class 1 material, having electrical conductivity of about 85% and tensile strength of about 60,000 psi. Available as rod, bar and plate.

TECHNICAL ASSISTANCE. For further information on these Anaconda alloys or for technical assistance in the selection of the right alloy to meet special problems, see your American Brass Company representative. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5981

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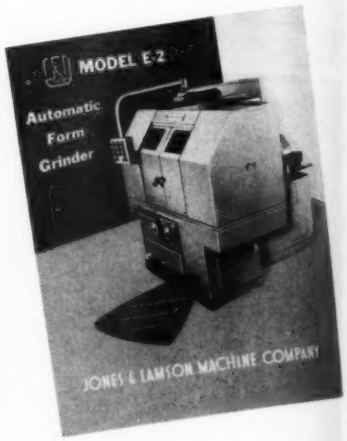
Catalogs . .

A Drill Jig Bushing catalog gives specifications for American Standard and ASA Standard in both ground and unground OD's, American Thinwall, tungsten carbide, and Superwear-X bushings. A quantity discount chart is included. Ask for your copy from American Drill Bushing Co., or Circle Inform-A-Gram No. C8.

Special Taps, Dies, and Gages are discussed in a bulletin, which gives complete size information on right- and left-hand high speed taps, dies, and thread plug gages. Write Field Tool Supply Co. for a copy, or Circle Inform-A-Gram No. C9.

High-Tool-Velocity Band Machines and their applications are featured in a new catalog on the Zephyr line. Specifications for four models are included in this bulletin from The DoAll Co., or Circle Inform-A-Gram No. C10.

An Automatic Form Grinder is highlighted in a new bulletin from Jones & Lamson Machine Co. Im-



portant features of Model E-2 and the Perpetual Form Control Wheel Trueing, automatic crush dressing, and automatic diamond dressing are explained. Ask company for a copy, or Circle Inform-A-Gram No. C11.

Precision Inspection Equipment catalog gives data on the Milwaukee line and gives specifications for all types of surface plates, angle plates, box parallels, squares, and straight edges. Get a copy from J. C. Busch Co., or Circle Inform-A-Gram No. C12.

Protect Against Flying Chips with the new magnetic Grip-Shields, described in a bulletin. They can be attached to any machine at any angle and swiveled, for complete safety. Contact The Dilley Mfg. Co. for a copy, or Circle Inform-A-Gram No. C13.

Precision Air Gaging Instruments, elements, and related accessory equipment are explained in a new 16-page catalog. Specifications and price data are also given in bulletin from The Dearborn Gage Co., or Circle Inform-A-Gram No. C14.

Constant-Power Gear-Shift Drill Presses are detailed in a brochure that gives specifications and features of the 18″ and 24″ models. Get your copy from Boice-Crane Co., or Circle No. C15.

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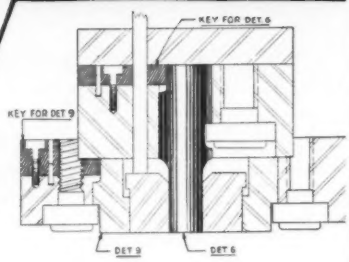
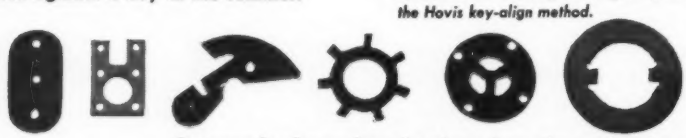
THE LATEST ADDITION TO OUR STANDARD UNITS
a must for irregular stampings

ELIMINATES ALL SET-UP ERRORS AND INSURES UNINTERRUPTED ACCURACY

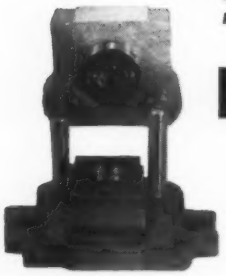
When producing irregular shaped stampings, it is important that the cutting members of the die are located in the proper radial alignment. Hovis has introduced the key-aligned die to meet this requirement . . . With the key-aligned die any press operator can install the inserts without the possibility of misalignment. This is accomplished with a flat on the insert which locates against a key in the retainer.



A section line drawing showing the principle of the Hovis key-align method.



An example of some irregular pieces these dies produce by merely purchasing special sets of parts on which we are glad to quote



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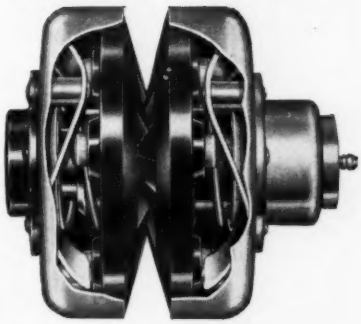
Hi-Lo Load-O-Matic Control Eliminates Pulley Slow Down



Hi-Lo Variable Speed Pulleys positively maintain the desired speed ratio over a wide range of load variation by means of an exclusive cam and cam follower assembly. This means:

Pulley speed is independent of load and load changes. "Drag" is eliminated and high shock absorbency provided.

Pulleys do not compress belt due to spring pressure. Springs are not driving members. They act only to keep pulley faces in contact with belt.

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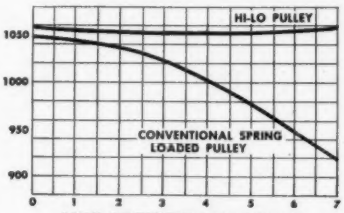
Double cams maintain constant belt alignment.

HI-LO PULLEYS COMPARED TO OTHER VARIABLE SPEED PULLEYS



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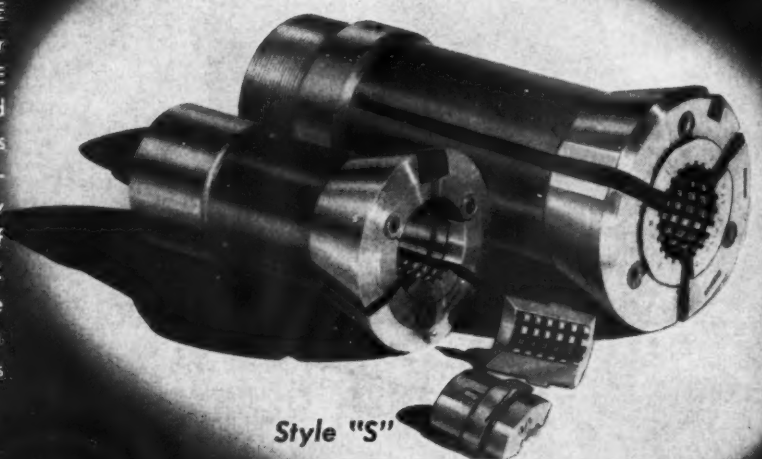

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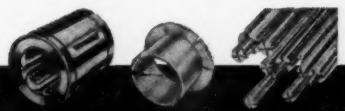

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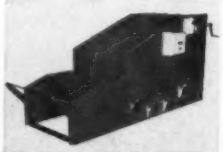

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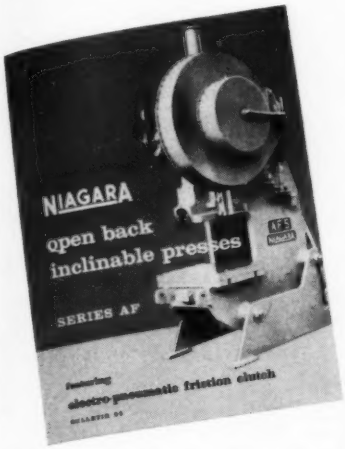


brake, is covered in a 24-page bulletin. Features and specifications are included in Bulletin 55 from Niagara Machine & Tool Works, or Circle Inform-A-Gram No. C16.

Bronze Wear Plates are offered in a brochure that lists specifications for slide plates and flat wear plates. Get your copy from Lamina Dies and Tools, Inc., or Circle Inform-A-Gram No. C17.

Metal Sawing Machines for shop or toolroom are described in a bulletin that gives specifications, features, and uses of three models, Bulletin 6500 from Peerless Machine Co. gives details, or Circle Inform-A-Gram No. C18.

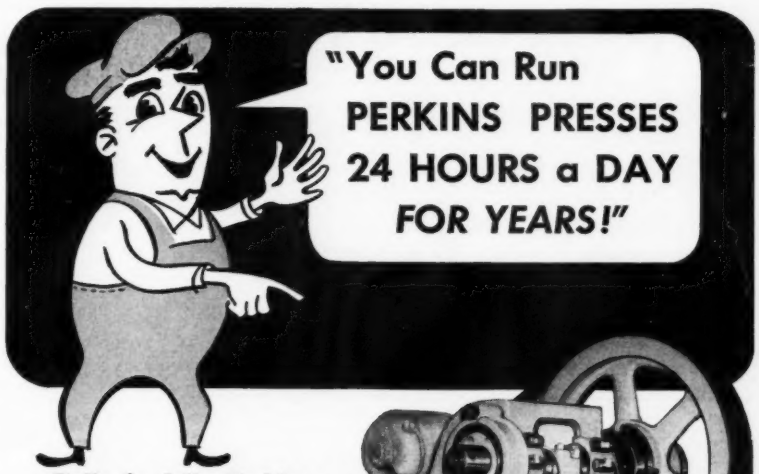
Unitized Tooling Maintenance manual has 20 pages of experience and practical tips written by a Unitized tooling user. Drawings accompany sections on proper punch length and die button height, punch and die clearance, and stripping essentials. For your copy, contact Punch Products Corp., or Circle No. C19.

Bi-Metallic Casting, for bonding dissimilar metals by the Al-Fin-process, is discussed in a catalog that illustrates applications and includes design data. Get your copy from Arthur Tickle Engineering Works, Inc., or Circle Inform-A-Gram No. C20.

Tracer Control Systems, applications, and components are presented in a bulletin which describes and illustrates hydraulic tracer control systems for 1-, 2-, and 3-dimensional applications on machine tools. Bulletin SB-2 is available from True-Trace Corp., or Circle Inform-A-Gram No. C21.

A Closed Hydraulic System for remote motion control or duplication is completely described in a new catalog. It gives engineering data on features, dimensions, accessories, uses, and installation of this remote control system. Write Hydronic Corp., for your copy, or Circle No. C22.

Abrasive Finishing Methods for stainless steel and steel are explained in a bulletin which details recommendations for producing satin finishes, Butler finishes, and bright finishes, using various abrasives. Copies available from The Lea Mfg. Co., or Circle No. C23.



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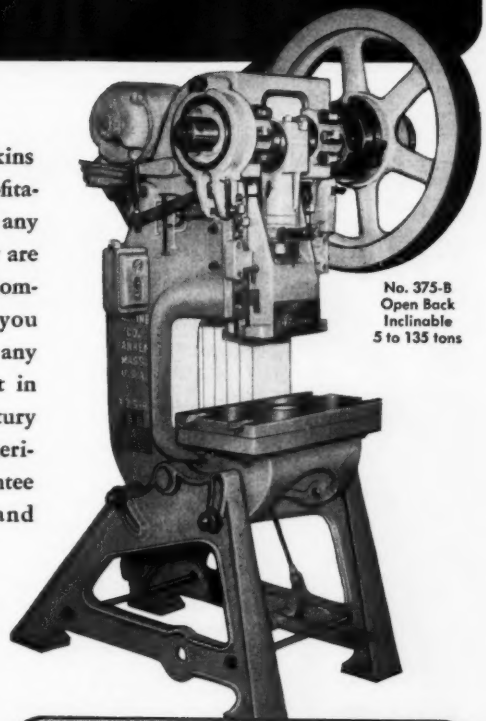

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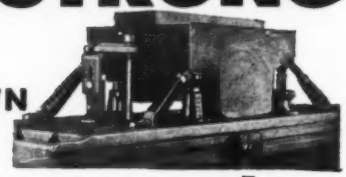
ARMSTRONG

SET-UP *and* HOLD-DOWN TOOLS



ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

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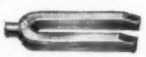

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ALL NEW MARK II Shoplifter

New Low Price $195.00 *

New Capacity Full 750 lbs.

All lifters at this price *are not* the same. Compare and note the quality of the new Mark II, which now replaces the Type D Shoplifter. Full 750 lb. capacity can be handled safely anywhere on the platform.

No-drift, full control hoist unit. Raise or lower the load to fractional positioning. Built for years of continuous service with minimum maintenance. *Complete* safety features included at no extra cost.

Applicable in small plants for "too heavy to lift loads" and in large plants to supplement powered equipment. The economical way to transfer molds and dies, unload trucks, stack in narrow aisles, or raise parts and machinery to working levels.

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*Priced f.o.b. Chicago

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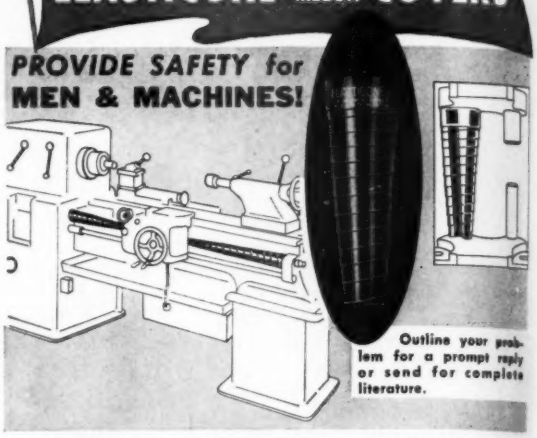
OUT GO SHUTDOWNS . . . INJURIES . . . REPAIRS

ELASTICONE® STEEL RIBBON COVERS

PROVIDE SAFETY for MEN & MACHINES!



Outline your problem for a prompt reply or send for complete literature.

Elasticones are metal-formed, cone shaped covers that open and close automatically to provide protection against dirt, damage, and catching of limbs, for all precision moving parts. Available in all finishes and sizes from ⅜" diameter up to 60" long.

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Raymac SOLID CARBIDE GRINDING TOOLS

FIRST STEP TO LOW COST BETTER WORK

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BURRS

When it comes to cutting labor and tool costs there is nothing like Raymac Solid Carbide Tools.

Raymac grinding tools reduce finishing time—small diameter holes can be ground without bell mouthing or surface crazing—finishes are in low micro inch range.

SOLID CARBIDE TOOL RECONDITIONING

The Second Step—keep your tools sharp—in good cutting condition. Let our engineers help set up an efficient reconditioning program for high production with low inventory of tools.

Get Details Today!

Raymac
DIVISION OF DEXCO CORP.
15490 Dale Ave., Detroit 23, Michigan

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Catalogs . .

Standard Mounted Wheel shapes and sizes are shown in a chart in a new catalog announced by Cin-

cinnati Milling Products Div'n, Cincinnati Milling Machine Co. A table showing recommended starting grades for various jobs is also included. Get Booklet PG-358 from the company, or Circle C24.

For Heavy-Duty High Temperature Applications use the new vacuum - induction - melted alloy M-252, introduced in a bulletin. Available sizes and forms, mechanical and physical properties charts, and detailed finishing information are included in this bulletin from Metals Div'n, Kelsey-Hayes Co., or Circle Inform-A-Gram No. C25.

A Micro-Drilling Manual contains 22 pages about problems, practices, techniques, and equipment for drilling holes from 0.001" to 0.020" dia. Get Booklet MD 85 from Dumore Co., or Circle C26.

A Multiple Drilling and Tapping Head line is described in a new brochure that fully illustrates and points out the advantages of the new types. Write Jarvis Corp. for your copy, or Circle No. C27.

Engineering Properties of the various types of Meehanite castings are presented in a bulletin. Density, effect of elevated temperatures, and wear resistance are also discussed. Write Meehanite Metal Corp. for Bulletin 32, or Circle No. C28.

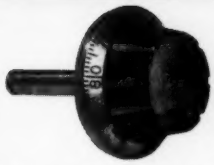
Precision Surface Plate accessory equipment is presented in a bulletin. Air-Lift angle blocks and riser blocks, straight blocks, and straight edges, are described. Contact The Herman Stone Co. for a copy of Bulletin B, or Circle Inform-A-Gram No. C29.

Larger Die Making requirements at lower costs can be met by a Punch and Die Maker described in a bulletin. Complete specifications for Model PDM and the Model PDF die filers are given. Get your copy from Rice Pump & Machine Co., or Circle Inform-A-Gram No. C30.

A Desoutter Air Tool Catalog contains specifications and features of the new silent compact Power Atom screwdrivers, corner screwdrivers, nut runners, miniature screwdrivers, wrenches, tappers, and grinders. Get a copy from Newage Industries, Inc., or Circle Inform-A-Gram No. C31.

4 Additional Burgmaster Turret Drills Purchased at as a result of 1st Machine's Performance

Beckman Instruments



Potentiometer Dial and Knob press-fit assembled using air-operated holding fixture mounted on Burgmaster Table.

Sequence of Operations: Place Dial and Knob in fixture; close fixture; drill, tap and fasten socket set screw. Tapping heads used to hold taps and hex wrenches — double tooling.

• This Burgmaster Bench Model "O" 6-spindle Turret Drill was recently purchased at the Helipot Division of Beckman Instruments, Inc. It is the fifth machine to be installed within a period of a year and is a further step toward producing better machined holes faster and cheaper at this modern plant.

• In the operation shown, the Burgmaster Bench Model Machine is used to assemble, drill, tap and fasten two parts of a Potentiometer Dial. Formerly, with a hand indexed turret drill, there was a problem of operator fatigue and rejects were high.

• Greater precision and enthusiastic operator acceptance has resulted from this Burgmaster installation — due to the speed and ease of operation. The Burgmaster turret power indexes at operator command, performing up to six operations at one location. Preselective spindle speeds, precision depth stops and a sensitive feed handle assure the most efficient working rate while increasing tool life.

Burgmaster Model 1C Six-Spindle Turret Drill — 12 speeds from 325 to 4050 — ½" drill and tap capacity in cast iron — 1 H.P.

95% of Burgmaster Users Report up to 230% Savings
Write for the complete facts. Free literature illustrates and describes machine features including specifications and accessories.
See us at: — National ASTE Show Booth No. 734, Detroit, Michigan

World's largest manufacturer of turret-type drilling and tapping machines.

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SMALL TOOL DIVISION – BURG TOOL MANUFACTURING CO., INC.
15001 S. Figueroa St., Box 311, Gardena, Calif. • Phone: FAculty 1-3510 – Phone, wire or write Dept. OA

'60

CIRCLE INFORM-A-GRAM KEY NO. 97

Yoder Rotary Slitters reduce inventory... speed production

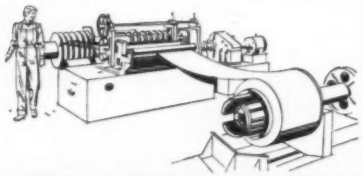
To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths... completely engineered lines for special requirements.

YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

YODER also makes a complete line of Cold Roll-Forming equipment and Pipe and Tube Mills. To profit from YODER'S years of engineering and service experience, contact your local YODER representative or send for the YODER Slitter Manual.

Investigate the many advantages of YODER-engineered Slitter Installations. Write today for this comprehensive, 80 page YODER Slitter Manual... it's yours for the asking!

THE YODER COMPANY
5501 Walworth Avenue • Cleveland 1, Ohio



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ROTARY SLITTING LINES

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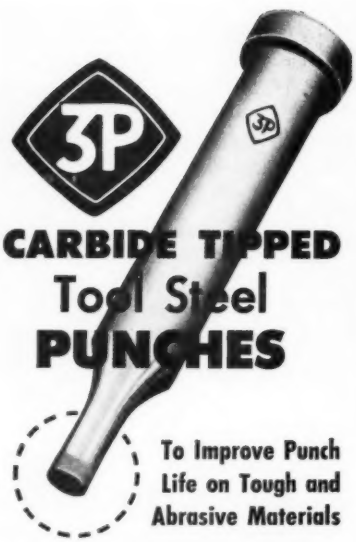

CARBIDE TIPPED Tool Steel PUNCHES

To Improve Punch Life on Tough and Abrasive Materials

In an exclusive process, Porter Precision Products WELDS Tungsten Carbide to tool steel. These punches are made to approved ASTE Standards. PORTER GUARANTEES THE STRENGTH OF THE WELD TO EQUAL THE STRENGTH OF CARBIDE ITSELF. The carbide will not come off.
3P Carbide Tipped Punches give longer wear life; can be used in your present steel dies. Available from stock—immediate delivery. Write for 3P Catalogue No. 200.

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P. O. BOX 208
CINCINNATI 15, OHIO

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Star Stainless screws have clean—bright and shiny—heads

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Pick the one that's right for your job!

It pays to specify

ACE
DRILLS
REAMERS
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Carbide Tipped and Solid Carbide
Premium Quality High Speed Steel

BLANK SETS

Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits.

DRILL SETS

Standard stock sets include Fractional, Wire and Letter size drills, packaged in convenient folding index cases.

Call your local distributor today—or write Ace direct for latest catalog and price information.

ACE DRILL
Adrian, Michigan
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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Catalogs . .

A 16-Page Booklet on the products and services of The Polymer Corp. outlines properties, applications, and availability of a number of industrial plastics. For your copy, write the company, or Circle Inform-A-Gram No. C32.

For Air, Oil, Water, gas, or chemical applications, use the new line of Series 20, 2-way valves described in a new bulletin. Complete data on all types is given in Bulletin 91022 from Airmatic Valve, Inc., or Circle No. C33.

A Precision Cross-Slide Table is described in a bulletin that gives details and specifications for work on mold cavities, plungers, dies, templates, and other intricate milling jobs. Get a copy from Lawrence H. Cook, Inc., or Circle Inform-A-Gram No. C34.

A New Metal Etching Control Material is described in a booklet that gives details, general procedure, and numerous applications. Write Eastman Kodak Co. for Booklet P-36, or Circle Inform-A-Gram No. C35.

A New Engine Lathe Model is covered in an 8-page booklet that gives engineering details and specifications. Write Nebel Machine Tool Corp. for a copy of Catalog 213, or Circle Inform-A-Gram No. 213, or Circle No. C36.

Two New Files added to the Clemson Star line are described in a bulletin which gives specifications for the American pattern and milled curved-tooth files. Get copies from Clemson Bros., Inc., or Circle No. C37.

A 28-Page Tap Selector reference details the correct tap to use for optimum production, regardless of type of material or hole. Correct gages are also listed in chart form. Contact Hanson-Whitney Co. for a copy, or Circle Inform-A-Gram No. C38.

Drills, Reamers, and Cutters manufactured of solid high speed steel, high speed cutting steel with carbide tip, and solid carbide are described in a bulletin from Special Drill & Reamer Corp. Circle Inform-A-Gram No. C39.

Stainless Steel Gage Blocks are presented in a new bulletin, which outlines such features as corrosion resistance, durability, stability, surface finish, and coefficient of expansion. Get your copy from The DoAll Co., or Circle Inform-A-Gram No. C40.

Solve Piping Problems by getting ideas from the five illustrated case histories of applications that used Tru-Seal fittings to eliminate leakage and positioning and overtightening damage. Get "Case Histories, Sheet No. 2" from Flick-Reedy Corp., or Circle Inform-A-Gram No. C41.

Standard Boring Bars, including micro-adjustable interchangeable head, micro-adjustable, and non-adjustable types, are offered in a bulletin. All use throw-away inserts. Engineering and specification data is included in Bulletin B-1259 from Wesson Co., or Circle Inform-A-Gram No. C42.

Longer wearing MILLIONTHS

Time you got acquainted with the world's first* and finest gage blocks. Blocks possessing correct temperature coefficient—absolute metallurgical stability. Blocks with a positive built-in wear factor—unconditionally guaranteed to be minus nothing from nominal size. Blocks, too, that feature chromium plated gaging surfaces to give you longer wearing millionths and lower gaging costs. Yes, it's time now to buy a set of

ELLSTROM CHROMIUM PLATED GAGE BLOCKS

MANUFACTURED AND CALIBRATED TO THE INTERNATIONAL INCH—EXACTLY EQUAL TO 25.4 MILLIMETERS

"W" Working Accuracy: +.000008"/−.000000" Parallelism: .000004" / Flatness: .000004"
"I" Inspection Accuracy: +.000004"/−.000000" Parallelism: .000003" / Flatness: .000003"
"L" Laboratory Accuracy: +.000002"/−.000000" Parallelism: .000001" / Flatness: .000001"

Above: Ellstrom Rectangular Set No. 92-R. Right: Ellstrom Square Set No. 81-SA, with accessories.

New Catalog contains prices and specifications—send for it today!

ELLSTROM STANDARDS DIVISION DEARBORN GAGE COMPANY
22038 Beech Street Dearborn, Michigan
Originators of Chromium Plated Gage Blocks

*Ellstrom—*Measuring in millionths for three generations*

Hjalmar Ellstrom (1863-1942)—He gave mankind the key to mass production of interchangeable parts. For it was he alone who conceived and produced the world's first combination gage blocks—the first master reference standards accurate to the infinitesimal millionth part of an inch!

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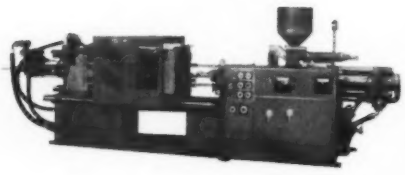
Toy Rocket Body — The great power of the Fellows injection side made possible the successful molding of this part. Tough to mold, super-high-impact styrene had to flow up a 23" total push through pin-point gates.
Waste Disposer Housing — A high-speed 13-ounce shot that most 12-ounce machines can't handle so fast or so well.
Seat Cover — Fellows 12-350 machine maintains high quality standards not possible with other 12-ounce machines.
Polyethylene Locomotive — 19 ounces of linear polyethylene. This is the largest linear shot ever made by I.M.C. using a 12-ounce machine.
Couplings — Wide range of controls on Fellows 12-350 holds precise tolerances and avoids stressing the parts.

FELLOWS MACHINES MOLD THE "TOUGH ONES"!



Industrial Molding Corporation, Culver City, California molded all these parts on their Fellows No. 12-350 injection molding machines. Can we help you on your tough molding problems? Your Fellows representative will be pleased to give you complete information.

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, 78 River Street, Springfield, Vermont, U.S.A. • Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.; 150 West Pleasant Ave., Maywood, N.J.; 5835 West North Avenue, Chicago 39; 6214 West Manchester Ave., Los Angeles 45.

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6	18	30	41	85	114	842	912	983	1053	1093	1133	1202	1254	1301	
7	19	31	42	86	116	843	913	984	1071	1101	1134	1203	1255	1302	
8	20	32	44	89	118	871	941	1031	1072	1102	1151	1204	1256	1311	
9	21	33	69	90	119	872	942	1032	1073	1103	1152	1231	1261	1312	
10	23	34	71	92	121	873	943	1033	1081	1104	1153	1232	1262	1321	
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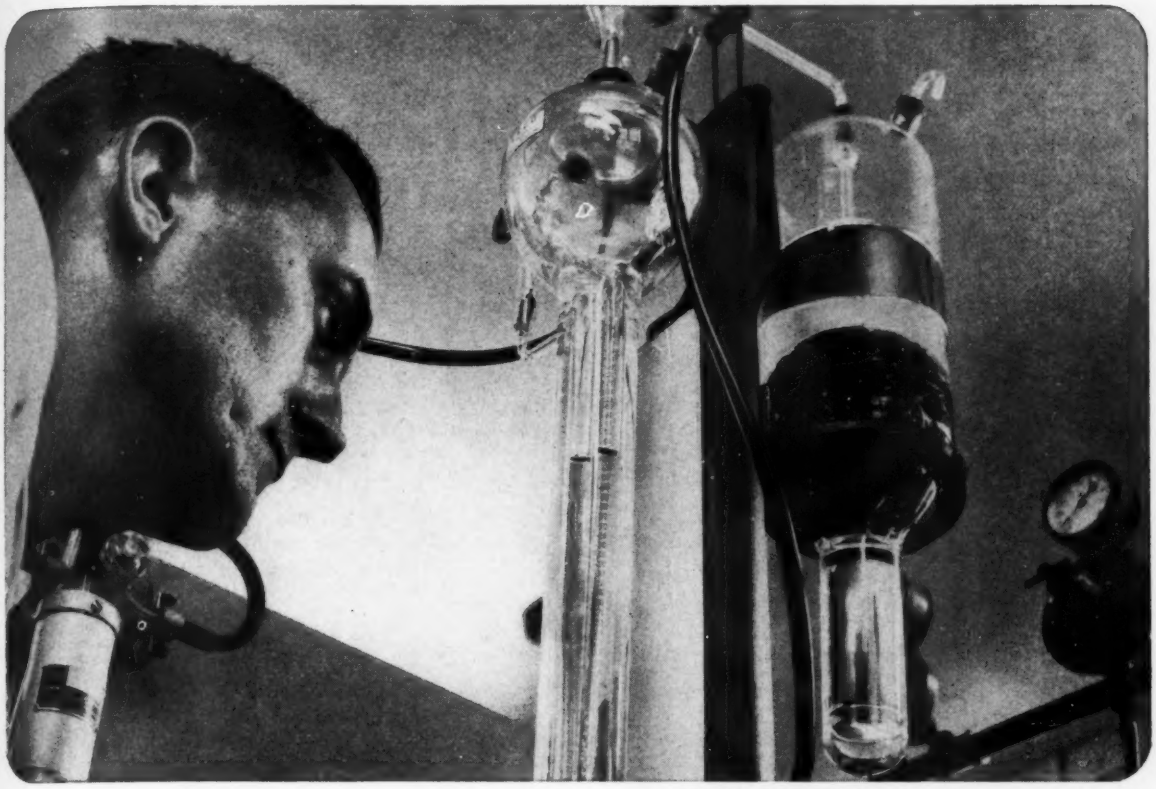
***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



QUICK, FAST TESTING for carbon content is done not once or twice but 8 times per melt in A-L's Chem Lab with this direct reading Leco carbon determinator.

Carbon content checked 8 times during melt to guarantee A-L tool steel hardenability

Lab tests for carbon eliminate your guesswork; provide high hardness, uniform hardenability, reproducible tool performance.

Because carbon has the greatest influence on hardenability, Allegheny Ludlum watches it carefully during the melt. Testing a specimen for carbon takes only a few minutes. Therefore, A-L checks for carbon content 8 times during the melt, and makes the necessary adjustments to insure accurate control of carbon. This control means Allegheny Ludlum can hold carbon content to a closer range than most customers specify.

Carbon control at Allegheny Ludlum assures you of precise response to heat treating. This control in the melt brings you predictable, *high hardness, uniform hardenability* and *reproducible tool performance.*

This is just one of the many things A-L does to insure high quality. Here are some others: close control over forging techniques, rigid temperature-time programming, careful testing of billets prior to processing to insure good surface and sound interior, control over annealing to give you the right hardness for your exact machining operation, thorough metallurgical testing to insure top tool steel quality and meeting of your specifications.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. TP-27

7281

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

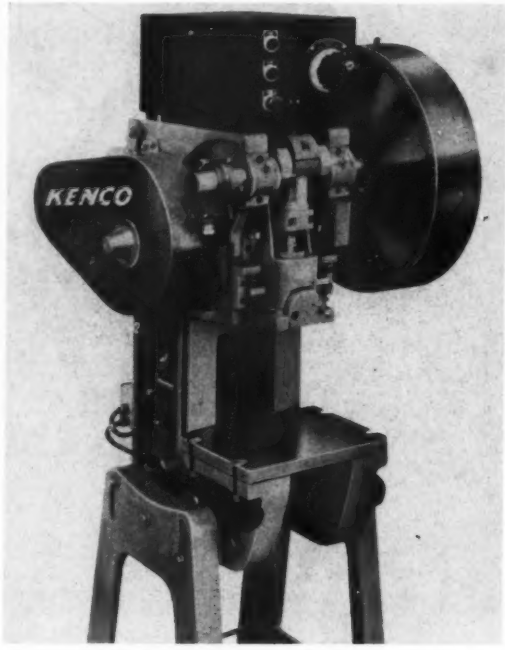
every grade of tool steel... every help in using it

CIRCLE INFORM-A-GRAM KEY NO. 101

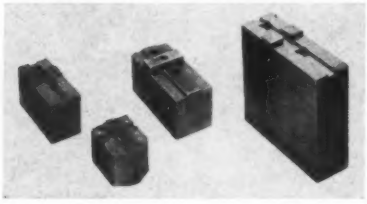
Product News

18-Ton Electro-Safe Press

Eliminate safety hazards in high production stamping by using the new 18-ton Kenco Electro-Safe press. Built-in Electro-Safe controls are readily interlocked with safety devices for effective use of overload detectors or other checking devices. There's no clutch or flywheel, eliminating hazards during loading cycle. For details on this and other tonnage models, write Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, or Circle Inform-A-Gram No. P1.



Standard Chuck Blanks



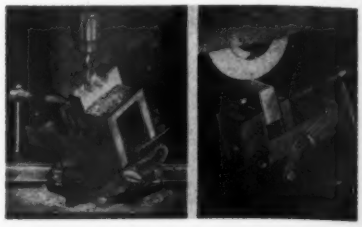
A chuck jaw blank line has been enlarged to fit over 300 master chucks. These standard blanks cut tooling costs and can be formed to hold all types of irregularly shaped workpieces. For details, write Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, or Circle No. P2.

T-Slot Cleaner

This handy T-slot cleaner cuts clean-up downtime and removes chips from T-slot in one swipe. Rear end of cleaner is used as a scoop to spoon chips from pockets of machine tables. Get details from Reid Tool Supply Co., 332 W. Delano Ave., Muskegon Hgts., Mich., or Circle No. P3.

Utility Vises

A new vise includes a swivel-tilt and angle vise for production, tooling, and maintenance. It's designed for quick and accurate milling,



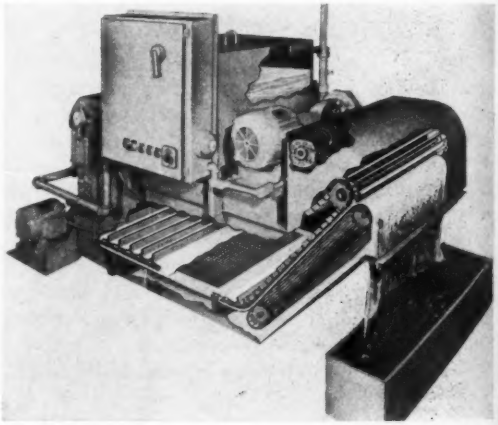
drilling, grinding, and also for checking layout work. Models 4992A and 4993A combine swivel base and angle base for compound angle setups. Write The Stanley Works, 195 Lake St., New Britain, Conn., for details, or Circle Inform-A-Gram No. P4.

Adhesive Film

Hold non-ferrous metals on magnetic chucks for surface grinding operations, using a new two-sided adhesive film. The grinding surface is not limited as it is with clamps. Cooling solutions do not effect the film. Information and samples are available from Interchemical Corp., Finishes Div'n, 120 Potter St., Cambridge 42, Mass., or Circle Inform-A-Gram No. P5.

Automatic Filter Unit

The new Hydro-Vac filter, a completely automatic unit, operates with pressure and vacuum on the media and the lowest possible liquid inlet height. This is done by designing the filter where the media travels, on the bottom of a settling tank and above a vacuum box. For details, write Hydromation Filter Co., 19661 Schoolcraft Ave., Detroit 23, or Circle Inform-A-Gram No. P6.



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Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

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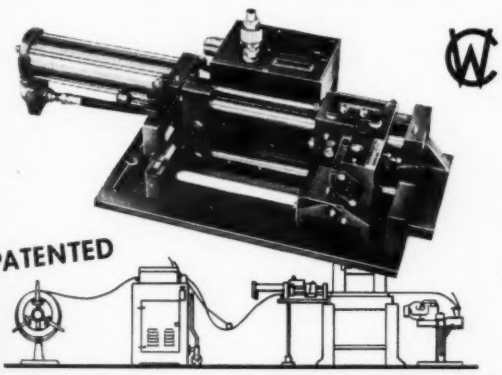
RUST-LICK, INCORPORATED 755 BOYLSTON STREET BOSTON 16, MASS.

CIRCLE INFORM-A-GRAM KEY NO. 1035



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603 Honeyspot Road, Stratford, Conn.

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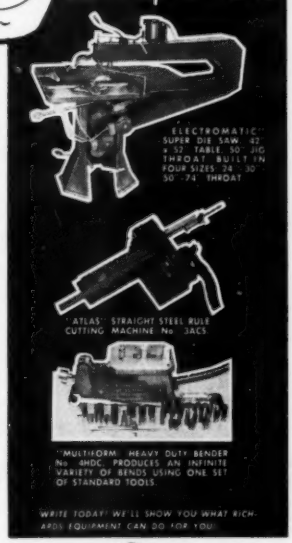
"ELECTROMATIC" SUPER DIE SAW. 42" x 52" TABLE. 50" JIG THROAT. BUILT IN FOUR SIZES. 24"-30"-50"-74" THROAT
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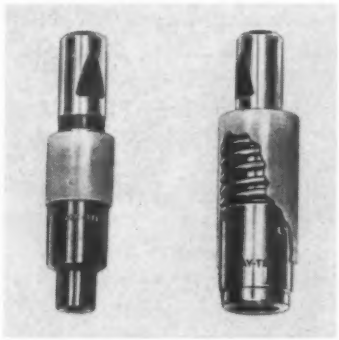
CIRCLE INFORM-A-GRAM KEY NO. 1037

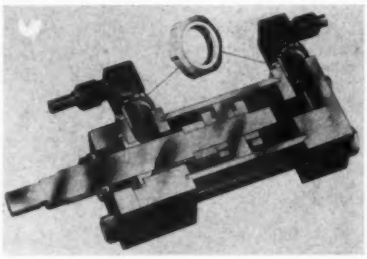
Product News

Stock Staking Tools



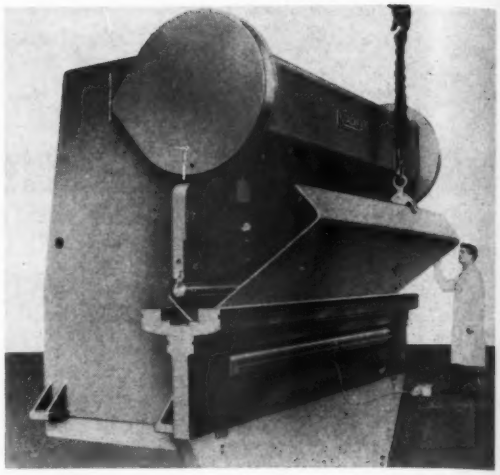
A new line of standardized staking tools can be used in conjunction with indexing fixtures on all types of air, hydraulic, kick, arbor, and impact presses for staking ferrous and non-ferrous metals. Eleven stock sizes from 3/16″ to 1/2″ dia are available from Jay-Tee Mfg. Co., 1515 N. 25th Ave., Melrose Park, Ill., or Circle P7.

Safe Port Seals



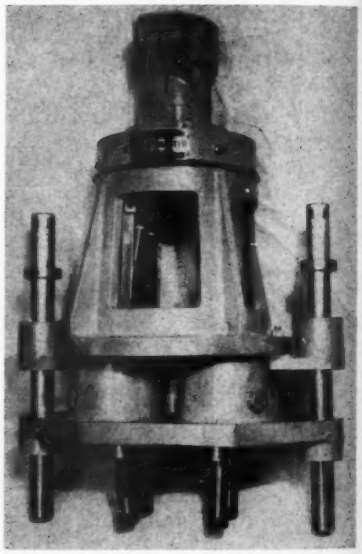
For perfect sealing, speedy positioning, and complete protection from overtightening damage, use these port seals that come on all standard models of air and hydraulic cylinders, boosters, and accumulators. They're threaded for hand-tightening onto the fitting. For details, write Miller Fluid Power Div'n, Flick-Reedy Corp., York & Thorndale Rds., Bensenville, Ill., or Circle No. P9.

New Press Brakes



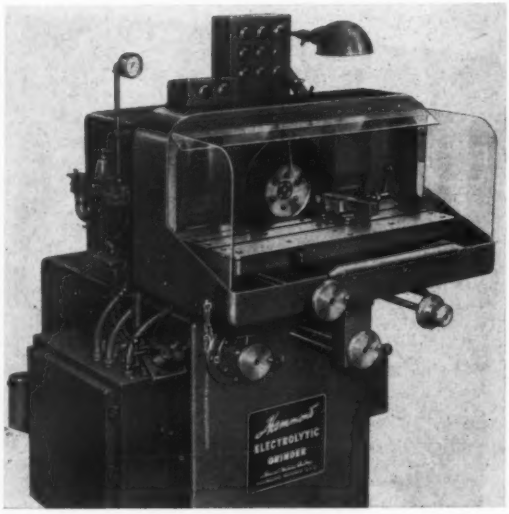
A press brake line, Series N, now includes 90-to 1500-ton models with over-all bend and ram lengths from 6′ to 24′, and bending capacities for 12 ga to 1″ mild steel. It also features power or manual clutch, brake, and treadle; two-speed transmission; and rocker-type end guide bearings for precise endwise alignment. Get Bulletin 89E from Niagara Machine & Tool Works, Buffalo 11, N.Y. or Circle Inform-A-Gram No. P8.

Angular Drillhead



An adjustable angular type drillhead with cartridge type spindle construction makes possible multiple spindle drilling or tapping of holes at an angle. Shown is a drillhead that taps four holes each at a 4° angle with the vertical. For details, write Thriftmaster Products Corp., 1012A N. Plum St., Lancaster, Pa., or Circle No. P11.

Large Capacity Grinder



This oscillating electrolytic grinder features a bigger wheel and table for handling large work. Model EG-10 has a 12″ x 29″ table, including wings. It can be tilted with a handwheel from 10° above to 22° below for horizontal, with no movement toward the wheel. Table in-feed and stock removal are controlled by a micrometer screw calibrated to 0.001″ and a microswitch which automatically retracts the table. The spindle, built for smooth operation, carries a 10″ dia wheel. Get Bulletin 244T from Hammond Machinery Builders, Inc., Kalamazoo, Mich., or Circle Inform-A-Gram No. P10.

Why suffer rejects . . . needlessly?

Replace guesswork gaging with "honest-tenth knowledge" and

WATCH REJECTS GO DOWN!

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- Tells operator actual hole size to fraction of .0001".
- Shows him front or back taper, barrel shape, bell mouth, ovality, etc.
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Because it makes the operator "master of tenths," Comtorplug is now the production control gage in hundreds of fast-moving programs: jet engine, household appliance, automotive transmission, high-speed machinery, etc.

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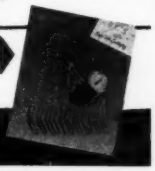
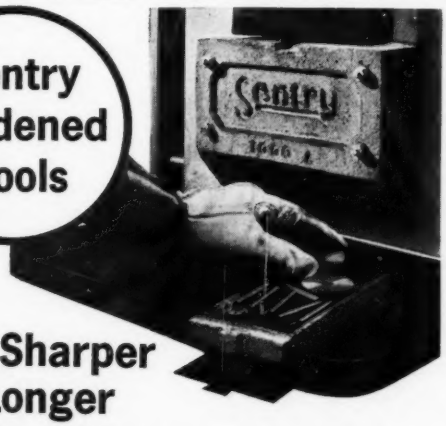


COMTOR COMPANY, 82 Farwell St., Waltham 54, Mass.

COMTORPLUG

CIRCLE INFORM-A-GRAM KEY NO. 1051

Sentry Hardened Tools



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- Can be used with all existing Whistler Magna-Die equipment.
- Creates substantial savings in tooling costs.
- Cuts punching operations in half or even more, in many instances.

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748 Military Rd., Buffalo 23, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1053

Product News

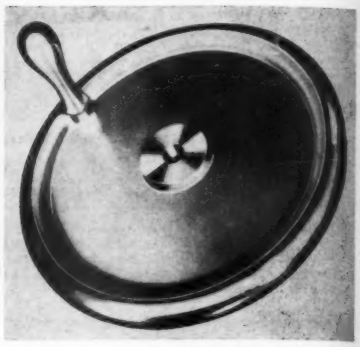
All-Steel Decoiler

This Bock decoiler features the cantilever design to facilitate simple and fast coil loading of coils of steel and other materials. Capacity range is from 18″ wide x 2000 lbs to 48″ x 7000 lbs. For details, write Elkart Welding & Boiler Works, Inc., 2132 S. Main St., Elkart, Ind., or Circle Inform-A-Gram No. P12.

Prevent Scale Formation

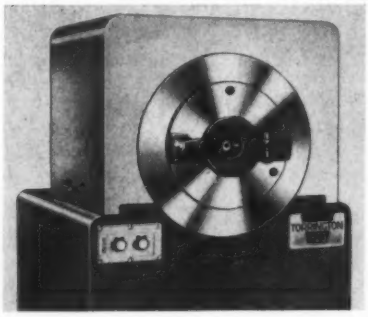
New chemicals that prevent scale formation on metals during heat treatment are now available from Navan Products, Inc., 900 N. Spulveda at Imperial, El Segundo, Calif. For information of Skalix scale prevention coatings, write Navan, or Circle Inform-A-Gram No. P16.

Solid Web Hand Wheels



A wide size range of solid web hand wheels are available in either straight or offset web styles. Ranging from 4″ to 15″ dia, the new hand wheels are designed to be safer for high speed applications. Contact Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, for details, or Circle Inform-A-Gram No. P17.

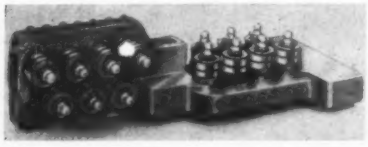
New Rotary Swager



A new pointer for steel, aluminum, and brass mill applications handles up to 1/2″ dia solid stock and 1½″ dia tubing. This economical model is designed for fast pointing and quick die changes. Contact Swaging Machine Div'n, The Torrington Co., Torrington, Conn., for details, or Circle Inform-A-Gram No. P13.

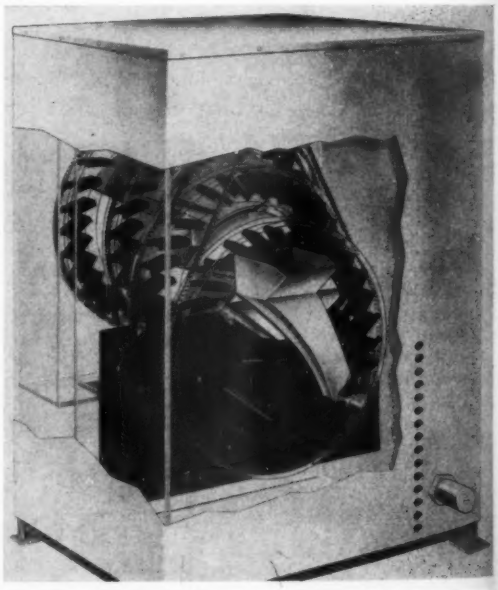
Wire Straightening Line

Adjustable rolls and needle bearings are features of a new series of wire straighteners from The Durant Tool Co., Providence, R. I. They'll straighten flat or round wire as well as wire with irregular cross-sections, and consist of two sets of 5-, 7-, 9-, or 11-grooved rolls set at right angles to remove material curvature on both planes. Details available from Durant, or Circle Inform-A-Gram No. P14.



Automated Ultrasonics

A new automated ultrasonic process integrates cleaning and degreasing with high speed production of metal parts. Auto-Sonex quickly processes machined and sheet metal parts directly from automatic grinders, screw machines, and blanking presses. One cost cutting feature is the reduction of need for high temperature cleaning. Literature is available from Metalclean Equipment Co., P. O. Box 177, Bala Cynwyd, Pa., or Circle P15.



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Self Centering **BORE GAGE**
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READING DIRECTLY IN 50 MILLIONTHS OF AN INCH

SMALL BORE GAGES	With interchangeable, springloaded Split Jaw Measuring Heads	
	Range .059" to .160"	$88.50
	" .160" to .280"	72.50
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LARGER SIZES	Employing a springloaded bridge, as illustrated	
	Range .400" to .700"	$72.50
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Complete in Hardwood case, without gaging head. Extra for gaging head reading in .000050" . . . $37.50 which may be interchanged in the various sets. Other heads reading in 20 millionths or .0005" available.

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Done to your specifications
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KIDDE PRECISION TOOL CORPORATION
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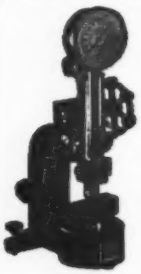
CIRCLE INFORM-A-GRAM KEY NO. 1082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Hole Sizes—No. 80 to 3/32"
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Lengths 1/4" to 3"
.0002 Tolerance on I.D.
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Material Handling
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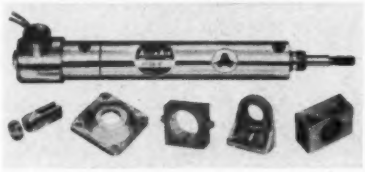
CIRCLE INFORM-A-GRAM KEY NO. 1085

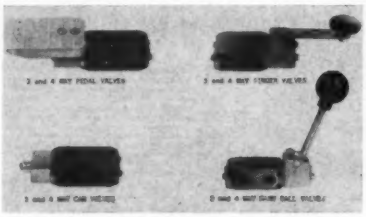
Product News

Valve-In-Head Cylinders



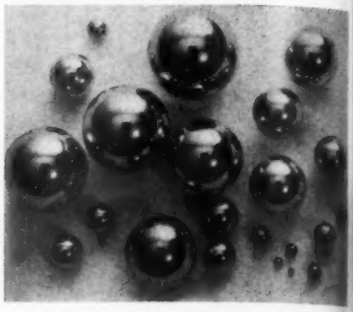
Two new models of single-acting type valve-in-head cylinders feature a 3-way solenoid valve built into the rear head. Model AVSA is for gravity or air return, and Model AVSR features an internal spring to return the rod. Literature is available from Allenair Corp., 225 E. 2nd St., Mineola, N.Y. or Circle Inform-A-Gram No. P18.

New Valve Line



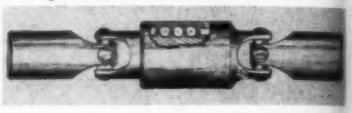
This new line of Rotoram 3- and 4-way valves features a stem which has a reciprocating and rotating motion during actuation. This action provides fast, smooth control of air cylinder applications. Contact Air-Mite Devices, Inc., 4401 W. Kinzie St., Chicago, for more data, or Circle Inform-A-Gram No. P19.

Tungsten Carbide Balls



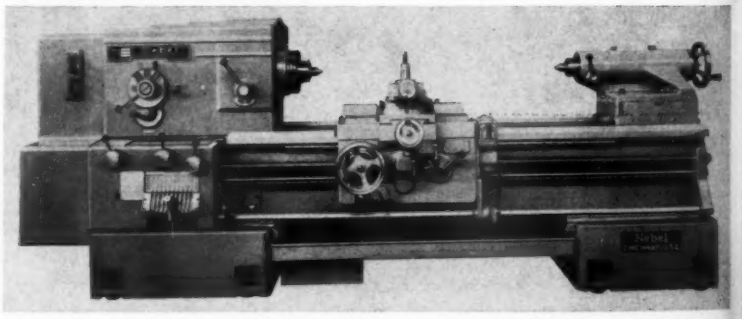
Use these high-precision tungsten carbide balls as valve elements handling abrasive materials, as indicator points, in bearings at temperatures to 800°F, and in other applications requiring maximum wear resistance, smoothness, and strength. Thirty-two standard sizes are available from Industrial Tectonics, Inc., Ann Arbor, Mich., or Circle Inform-A-Gram No. P20.

'Tiny' Universal Joint



A new telescoping miniature universal joint allows greater freedom in the design of systems where the precise transmission of power is essential. Two preloaded ball splines provide lateral travel and a minimum amount of thrust on connected components. For details, write Falcon Machine & Tool Co., 209 Concord Turnpike, Cambridge, Mass., or Circle No. P21.

HD Precision Machining



This heavy-duty engine lathe is capable of handling a wide variety of precision heavy-duty jobs. Model HD 2013 features a three-bearing spindle, and a quick-change box that provides 60 different feeds from 0.0027" to 0.192" and 60 thread changes from 1 to 72 threads/in, including standard pipe threads. For details, write the Nebel Machine Tool Corp., 3401 Central Parkway, Cincinnati 25, or Circle No. P22.

A simple, effective, low cost
ANTI-CORROSION TREATMENT
during storage, production and shipment

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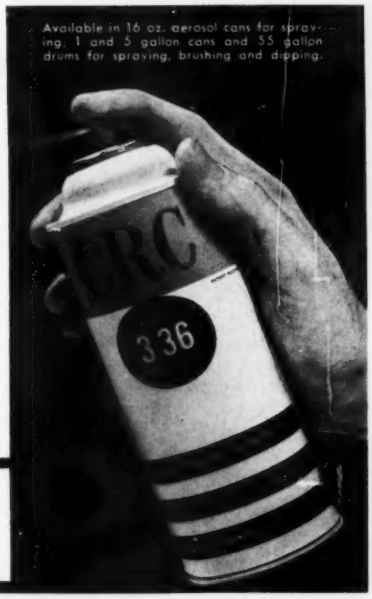
A molecular film that first displaces moisture from grain boundaries, pores and cracks and then seals the surface against corrosive action, CRC 3-36 keeps metal surfaces new. Easily applied by spray, brush or dip, CRC 3-36 never becomes hard or brittle, normally need not be removed when metal is subsequently processed. Non-irritating and non-toxic to humans, has faint pleasant odor.

Also preserves tools, dies and fixtures, loosens "frozen" parts, has beneficial lubricating effect.


Available in 16 oz. aerosol cans for spraying; 1 and 5 gallon cans and 55 gallon drums for spraying, brushing and dipping.
CRC
3-36

WRITE TODAY! *Send for free copy of CRC 3-36 Bulletin which gives complete product specifications and describes cost-saving applications.*

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Cat. #6551 — Signal box	55
Cat. #6131F — Stand	29.75
Cat. #6201 — Stand and Signal box (Self contained unit)	175
Cat. #650 — Not shown — Dial indicator for use with #6501	30
Cat. #6502 — Not shown — Coupling to connect #6501 to #650	5

For Complete Information request our 96 Page Catalog — Contact any of our 4 "Coast to Coast" Locations or your nearest Local Distributor.

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When writing to any of the above locations, refer to DEPT E-3

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The WELLS Model 600 Metal Cutting Band Saw

for Tool and Stock Room Service

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for Medium Production Jobs

Rugged in design, dependable in operation, the Wells Model 600 is the ideal saw for tool and stock rooms . . . gives excellent service on medium production jobs. Uses ⅝" blade. Adjustable, uniform gravity feed is provided by hydraulic stabilizer and special coil spring. Casters available for portability. Write for Bulletin 260-A.

Wells saws

Wells

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WELLS MANUFACTURING CORPORATION
1940 Cedar St., Three Rivers, Michigan

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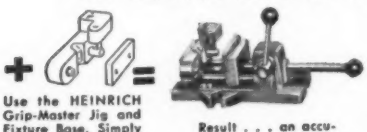
THE ORIGINAL SCREWLESS DRILL PRESS VISE

POSITIVE LOCKING GUARANTEED

Some models have sides precision ground square with jaws for machining from 2 or 3 sides. Jaw widths 3", 4", 6" and 8" . . . from 3" to 9" openings.

CUT TOOLING COSTS UP TO 75%



Use the HEINRICH Grip-Master Jig and Fixture Base. Simply add false jaws and bushing plate.

Result . . . an accurate, low-cost Drill Jig.

Send for BIG, FREE 28-page catalog.

HEINRICH TOOLS, INC., DEPT. 130-C

Racine, Wisconsin

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TOOLING BALLS

- Durable; corrosion-resistant. Made of Type 440-C stainless steel, hardened to 55-58 Rockwell C.
- Highly accurate. Ball size held to ±.0001" for fixture balls; ±.00002" for checking balls.
- In stock: Types 224 and 448 in 7 ball sizes, ¼" to 1" by ⅛" steps; Type 348, with ½" ball and shouldered shank tapped 6-32. Other sizes to order.

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- ★ *direct reading*
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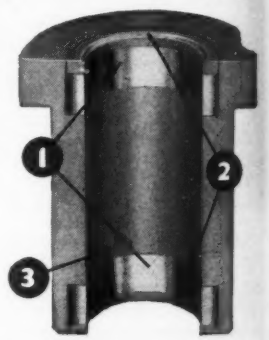
CARBIDE INSERTED MEYCO BUSHINGS Can Cut Production Costs!

MEYCO carbide inserted drill jig bushings have been successfully saving money on production runs for the past decade. Performance: same as solid carbide, but need not be handled with kid gloves. Greater economy, because of long life at less cost. You can enjoy the advantages of greater accuracy for a longer time, less spoilage, less machine down-time, added drill and jig life with MEYCO carbide inserted drill jig bushings. Get the full story now: write for new Bushing Catalog No. 41.



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1. Tungsten carbide rings at the points of wear; **2.** Steel rings protect drills and carbide; **3.** Special hardened alloy steel body.

MEYCO **W. F. MEYERS CO., Inc.**
BEDFORD, INDIANA
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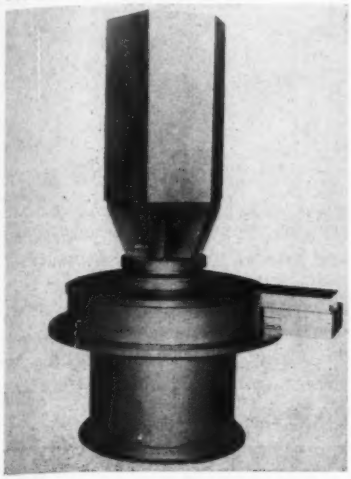
CIRCLE INFORM-A-GRAM KEY NO. 1104

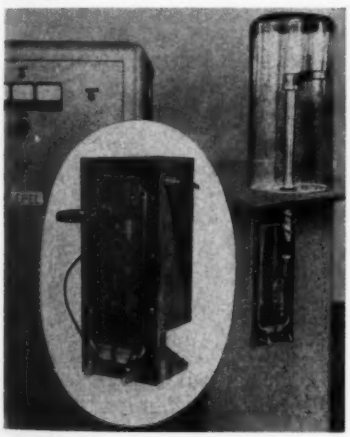
Product News

New Indexing Table



New mechanical indexing rotary tables are now available in a 42" dia model with stationary mounting column. This unit, designed for heavy-duty work, can be set up for 4 to 24 indexes or patterns. The Versa-Table's skip arrangement also permits skipping 1, 2, 3, or 5 stations each index. Write The Savage Engineering Div'n, The Lithibar Co., 344 W. 14th St., Holland, Mich., for details, or Circle Inform-A-Gram No. P23.

Energy Transfer Device



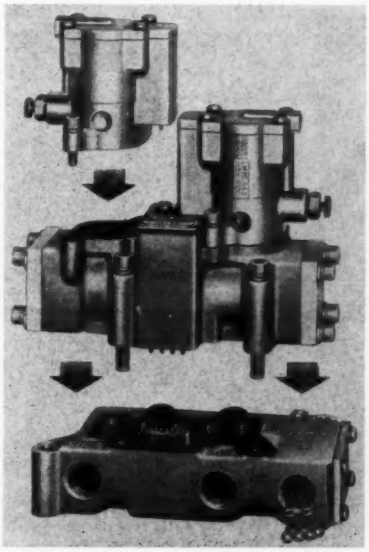
This modular unit, with heavy copper terminal of low impedance and high current-carrying capacity, is designed to be connected as an energy transfer device between a high frequency generator and a low impedance work coil. Model CT units are available in 1, 2, 4, 6, and 8 sections, rated at from 100 to 800 KVA. For details, write Lepel High Frequency Laboratories, Inc., 55th St. and 37th Ave., Woodside, N.Y., or Circle No. P24.

Medium Duty Sanders

High torque and lightweight construction have been combined in a new medium duty 58S Series of 22 air-powered vertical sanders.

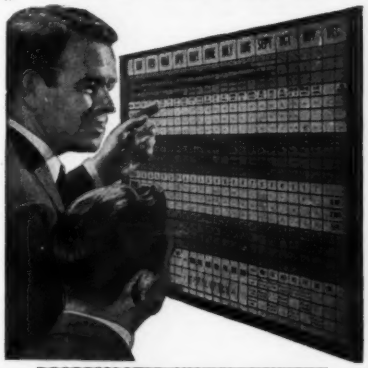
Twelve are equipped with governors—six of which range from 1850 to 8500 rpm. Shown is one of the non-governed models with 1500 to 7200 rpm speed range. Write Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio, for information, or Circle No. P25.

4-Way Control Valves



A new line of Speed King 1/2" single- and double-solenoid plug-in type pilot-operated 4-way control valves feature fast, automatic completion of electrical and pneumatic circuits. One-piece solenoid pilot housings and aluminum construction reduce maintenance time. Write for Bulletin SPL to Valvair Corp., 454 Morgan Ave., Akron 11, Ohio, or Circle No. P26.

How To Get Things Done Better and Faster



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Full 1/3 h.p. G. E. Motor

USE IT EITHER WAY

HORIZONTAL

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At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

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HAND WHEELS
Straight Type
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SPECIALS
• HAND KNOBS
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GRADUATED DIALS
SPECIFY TOMCO FOR DEPENDABILITY
A Complete line of high grade hand knobs, levers, handles, hand wheels, graduated dials is available for immediate shipment from stock of standard items. Specialty items made to your specifications.
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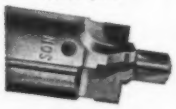
"A.N.D." and "M.S." HYDRAULIC CONTOUR CUTTERS in stock

A.N.D. 10050 internal

Economy series; integral plain pilot

Turret lathe and drill press series; integral carbide reamer pilot



Heavy duty series; replaceable carbide reamer or plain pilot, carbide and HSS

MS33656, MS33657, MS33514, and MS33515 O.D. flat form tools

Carbide tipped High speed steel

MS33514 internal

Solid carbide, carbide tipped, high speed steel models

MS16142 internal S.A.E.

Carbide tipped; plain or reamer pilot

Write for sizes and prices.

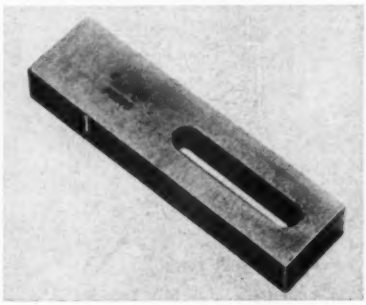
SONNET Tool and Mfg. Co.
580 North Prairie Avenue, Hawthorne, California

CIRCLE INFORM-A-GRAM KEY NO. 1122

Product News

Jumbo Plain Straps

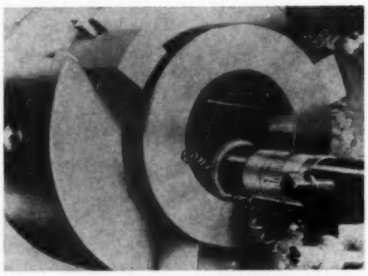
A new line of jumbo-sized plain straps, for special applications requiring extra-large strap clamping,

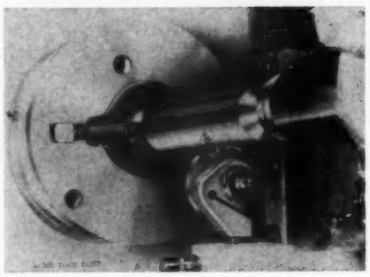


are made of mild steel for re-working, carburizing, and hardening. They're available in 4¾" to 12" lengths. Write Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, for details, or Circle Inform-A-Gram No. P27.

New Thread Cutter

Lower thread cutting costs, using a new tool available from Acme Tool Corp., 71 W. Broadway, N. Y. It features a cutting disc with





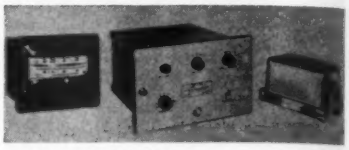
a negative profile which cuts both sides of an individual thread simultaneously. An easily-read easily-set scale determines the angular setting of the cutter, and since the chips come off on either side of the thread, damage is reduced. Internal and external tools are available from Acme, or Circle Inform-A-Gram No. P28.

New Vernier Caliper

Here's a new improved vernier caliper that makes reading easier, faster, and more accurate. Mauser vernier caliper No. 193 is designed

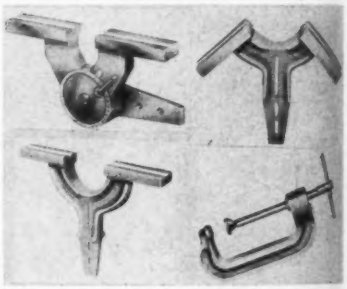
for OD, ID, and depth measuring and has a maximum capacity of 6¼", with 0.001" reading on both lower and upper scales. Contact Scherr-Tumico Co., 200 Lafayette St., New York 12, for details, or Circle Inform-A-Gram No. P29.

Radiation Thermometer



Automatically measure and control temperature of moving or stationary objects without physical contact with the Thermodot radiation thermometer. Model TD-3 has high sensitivity (7° to 2000°F), and instrument response is rapid and accurate, completely automatic and continuous. For Bulletin R-100, contact Radiation Electronics Co., 5600 W. Jarvis Ave., Chicago 48, or Circle No. P30.

Work Holders and Clamps



For short-run welding, soldering, and brazing where the cost of permanent jigs is prohibitive, use the new line of work holders and clamps announced by Wales-Strippit, Inc., a unit of Houdaille Industries, Inc., 212 S. Buell Rd., Akron, N.Y. Adjustable holders and right and straight angle types can be used for positioning and holding pipes, rods, etc. Write the company for literature, or Circle No. P31.

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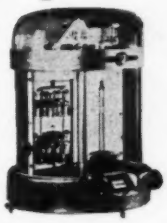

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STEEL TYPE

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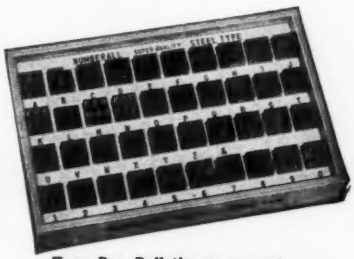

Type Box Bulletin on request.

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HUGUENOT PARK STATEN ISLAND 12, N. Y.

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Leitz OPTICAL JIG BORER

- Capacity of Coordinate table 6" x 6"
- Setting from master glass scales in .00005"
- Setting of rotary table in 10 seconds
- Spindle head tilts for oblique holes up to 15° from vertical

Request new 8-page catalog 82-4T

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137-TP VARICK STREET, NEW YORK 13, N. Y.

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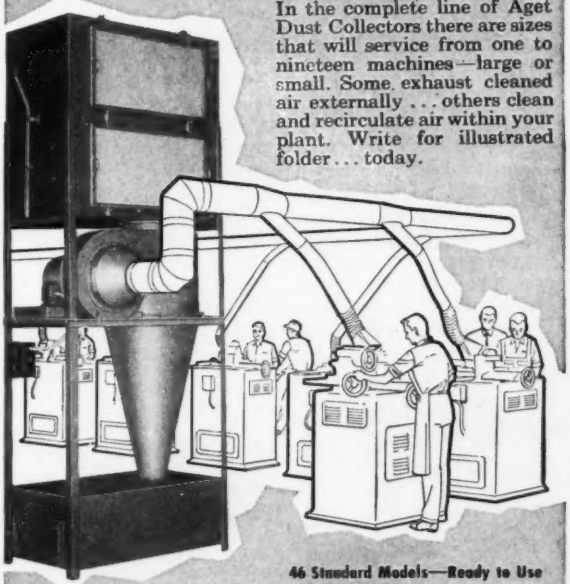
heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



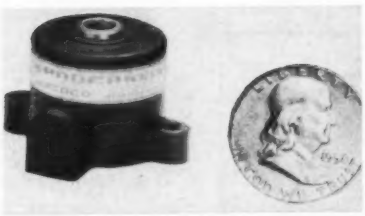
46 Standard Models—Ready to Use

AGET manufacturing company
1394 Church Street • Adrian, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1134

Product News

Nylon Air Cylinders



The Fabco Pancake air cylinder line is now made of molded nylon, which cut costs while maintaining the high standard of ruggedness. These cylinders are ideal for limited space applications and where other cylinders cannot be used, such as in corrosive atmospheres. Write Fabco, 1231 Main Ave., Cleveland 13, for details, or Circle No. P32.

ANOTHER Anderson TIME-SAVER

MODEL HP-010

ACCURATE STRAIGHTENING . . . AT LOW COST

The Anderson Hydraulic Hand Press was developed to *reduce costs.* Checking and straightening are accomplished in one position . . . eliminating the time consumed shifting parts back and forth from checking fixtures to straightening anvils. Efficient hand hydraulic pumps power various models of presses ranging in capacity from 10 to 50 tons. Attachments make possible the checking of stepped or odd shaped parts with centers. Different lengths of work can be handled by easy adjustment of rolls and centers. A pressure gauge is standard equipment. A special attachment is an indicator calibrated to thousands of an inch for locating high and low spots on the work, and to indicate how much the shaft is bent under pressure. An Anderson Hydraulic Hand Press can help you solve your straightening problems.

Anderson

Write for Bulletin No. 3-46

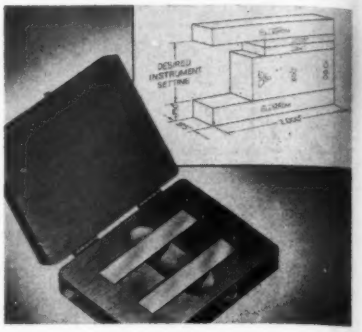
ANDERSON BROS. MFG. CO.

ROCKFORD, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 114

New Master Parallels

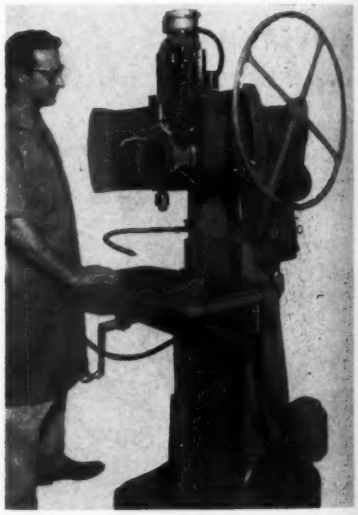
For accurate, fast, and easy setting of internal measuring instruments, use the new Ellstrom master parallels. Just assemble the gage block combination required to



obtain the desired instrument setting—then wring on the master parallels, as shown. There are no clamps or holders to cause distortion and error. Get details from Ellstrom Standards Div'n, Dearborn Gage Co., 22038 Beech St., Dearborn, Mich., or Circle P33.

6-Spindle Turret Drill

A smoother, stronger, trouble-free drive that improves machine accuracy and finish have been incorporated into the Burgmaster IC turret drilling machine. Modifica-



tions in the transmission utilize an electric clutch for high speeds and an over-running roller clutch for low speeds. Get details from Burgmaster Corp., 15001 S. Figueroa, Gardena Calif., or Circle Inform-A-Gram No. P34.

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(H. S. S. and Carbide) for Holes from 1/16" upward

Standard and Special Boring, Facing and Internal Threading Tools. Write for Data.

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PROMPT SERVICE

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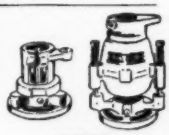
. . . and plan your small hole drilling & tapping operation on a low cost, maximum production basis



ETTCO-EMRICK
MULTIPLE SPINDLE HEADS

UNIT-ENGINEERED *for drilling or tapping on any drill press*

No one type will do for every job. That's why we make 'em all—and the correct custom tooling for faster handling of the parts. The Ettco system is a completely integrated service; not just multiple heads with spindles reaching into the air!

Ettco engineers can tell you without obligation which type best suits your specific job. They're all easily attachable to your present drill press, tapping machine or automated special. Standardized, reuseable components mean lowered costs. Interchangeable face plates permit quick switch from tapping to drilling. Write for catalog.

Ettco Multiple Heads shown clockwise: Fixed spindle; Geared Adjustable; Knuckle-Head Adjustable

Ettco-Emrick

The only complete line manufacturer of drilling & tapping equipment for the entire small hole field

See your authorized Ettco distributor

ETTCO TOOL & MACHINE CO., INC.
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VALUABLE REFERENCE

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JERGENS TOOL SPECIALTY CO.

DEPT. TP-3, 712 E. 163rd ST., CLEVELAND 10, OHIO

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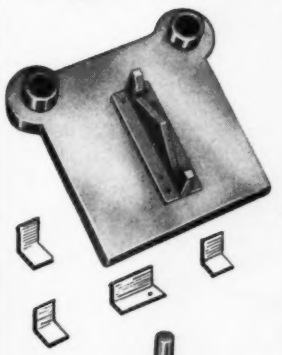
Punches and Dies

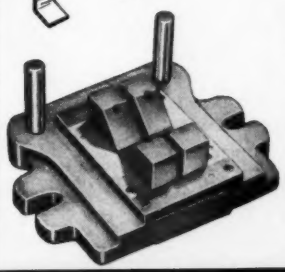
Angle Iron Cut Off Die



No. 18, cut off die, for 2" x 2" x ¼" and lighter angles. Mounted in leader pin die set. Fits 'most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut WITHOUT DISTORTION. Another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Also adaptors and die shoes to convert your press. Each precision-made.

28 *years of serving your punch and die requirements*

What are your punch and die needs? Consult us about your problems. Prompt service on "specials" made to your order.



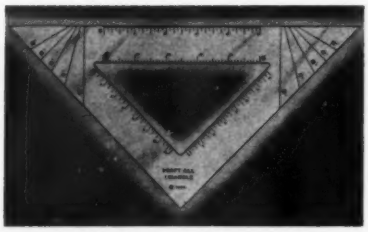
SEND FOR FREE CATALOG NO. 157 AF, illustrating our standard punches and dies and complete line of modern sheet metal fabricating equipment. NET PRICES SHOWN.

WARD Machinery Co. 564 West Washington Chicago 6

CIRCLE INFORM-A-GRAM KEY NO. 1154

Product News

Drawing Triangle



The advantages of protractor, straight edge, and scales are designed into this one instrument. The Draft-All triangle can be used to construct complete mechanical drawings. It has angle guide lines and the most popular scales for all applications. It's available at $2 from Draft-All Triangle Co., 152 W. 42nd St., New York 36, or Circle No. P35.

FEDERAL gives you

Cost-cutting Automation

eliminates specialized, more costly equipment!

Case histories prove that you can step up production many times — cut tooling and production costs substantially with a Federal!

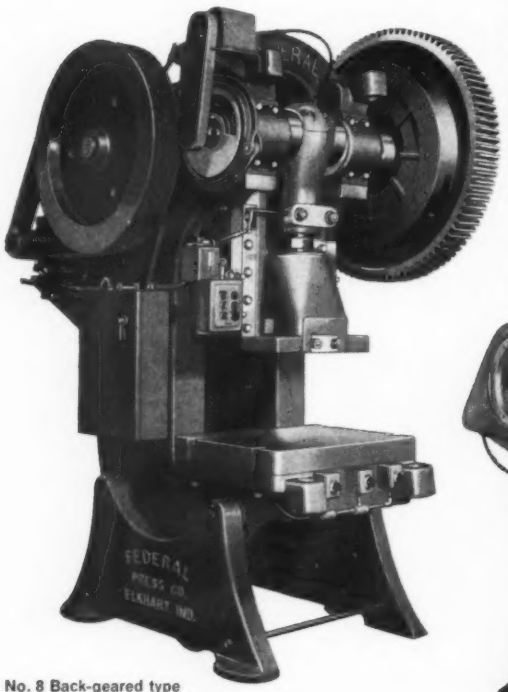
NEW NON-REPEAT AIR CLUTCH PRESSES with dual interlocking control system, provide the ultimate in safety and high-speed operation.

DIAL FEED PRESSES. Gear or chain driven. Fast, smooth, safe! Up to 20 multiple station operations—up to 300 indexes per minute.

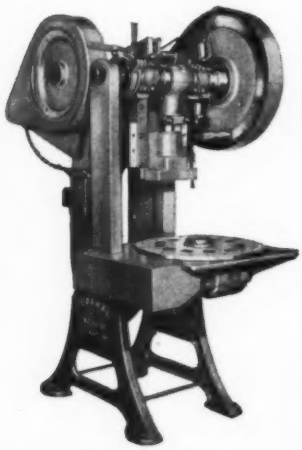
SPECIAL PRESSES. "Flying Cutoff" increases production—cuts any length. Other presses for trimming cap screws, etc.

STANDARD PRESSES. Geared and flywheel types.

Federal assures you of the finest workmanship—best features—Meehanite Iron castings—oversized crank shafts, Timken bearings, solid, web-type flywheels, symmetrical rams, longer "V" ways and gibs.



No. 8 Back-geared type with Federal's newly designed Air Clutch



No. 3 Dial Feed, chain driven. Capacity 26 tons.

FEDERAL PRESS COMPANY
607 Division St., Elkhart, Indiana

FEDERAL Open Back Inclinable PRESSES
34 Years of Quality Construction

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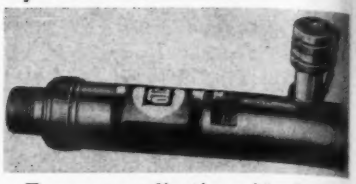
Hydraulic Ram Line

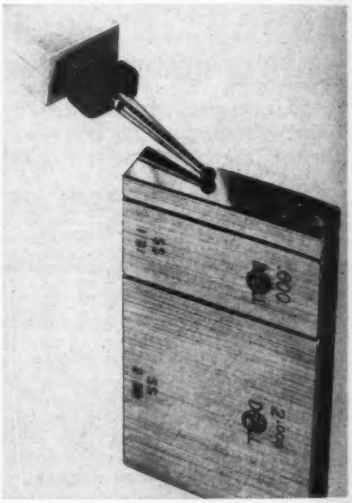


For easy application of hydraulic power to many operations, use the new line of single-cylinder, single-acting hydraulic rams from Owatonna Tool Co., 547 Cedar St., Owatonna, Minn. Nine sizes are available with from 2- to 50-ton capacities, with maximum working pressures of 8,650 to 10,000 psi. Contact the company for data, or Circle No. P36.

New Machinable Alloy

A new aluminum screw machine stock, X6262, offers better machinability and greater strength than alloy 6061, and possesses corrosion resistance and finishing characteristics comparable to alloy 6061. For more information, write Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, or Circle Inform-A-Circle No. P37.

SS Gage Block

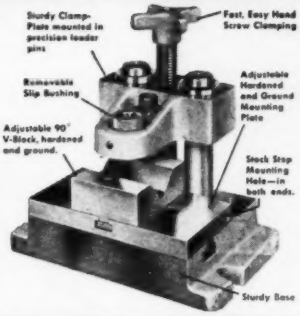


Greater continued accuracy and much longer life are features of the new DoAll stainless steel gage blocks, for shop and inspection use. They require no more than normal care given any precision gaging instrument and tests have proved that they have superior hardness, stability, corrosion resistance, surface finish, wear, and density. For more data, write The DoAll Co., Des Plaines, Ill., or Circle No. P38.

REPCO Time-Saving Tools

ADJUSTABLE V-BLOCK DRILL JIG

Saves Set-Up Time—Increases Output

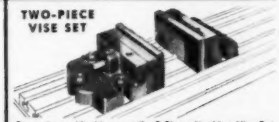

Sturdy Clamp-Plate mounted in precision leader pins
Fast, Easy Hand Screw Clamping
Removable Slip Bushing
Adjustable Hardened and Ground Mounting Plate
Adjustable 90° V-Block, hardened and ground.
Stock Stop Mounting Hole—in both ends.
Sturdy Base

Here is a versatile and accurate V-Block that makes center and off-center drilling, tapping, and reaming easy and precise. Four-way V-block adjustment simplifies handling a wide range of work. Fast, easy positioning and clamping speed production. A centering locator plug and T-slots in the mounting surface plates assure fast, easy, on-center adjustment. Drill capacity #80 to 7/16" diameter. Handles stock from 1/4" to 2" diameter.

TRUE-CENTER ADJUSTABLE TOOL HOLDER

The REPCO Adjustable Holder is a precision-built tool, having two-piece construction which provides fast adjustment of the main body to compensate for as much as 1/8" machine misalignment. Cuts down on tool wear, breakage, and scrap.

TWO-PIECE VISE SET

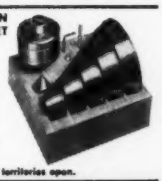


Save time with this versatile 2-Piece Machine Vise Set. Use as general-purpose vise, angle-block, or separate clamping device. Opening limited only to length of machine base. Light, accurate, rigid. Two sizes: 6" and 8".

CHUCK JAW TRUING-RING SET

This Ring Set saves time, cuts cost of boring jaws. With correct diameter rings at hand, you gain hours of productive time. Plated rings range from 1" to 4" by 1/8" increments. Handy peg-type rack keeps rings in place.

COMBINATION LIVE-CENTER SET



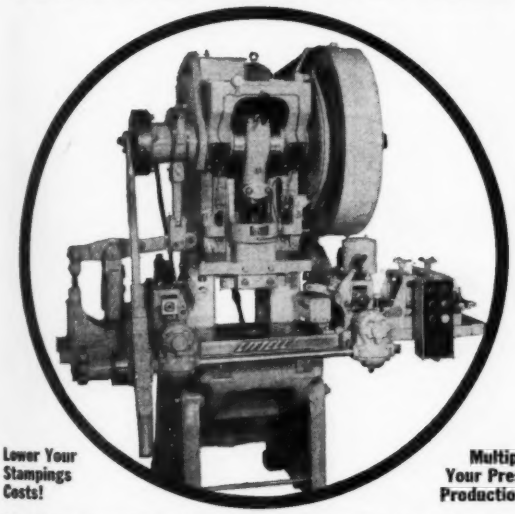
Heavy-duty live center plus six interchangeable adapters, ranging from a point to 6 1/4" dia. ball. Saves costly set-up and machining time necessary to make large-diameter centers. Straight and various taper shanks available.

Write for complete information—Exclusive agent territories open.

REPCO ROCKFORD ENGINEERED PRODUCTS CO.
2322—23rd Avenue • Rockford, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1171

LITTELL ROLL FEEDS



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Multiply Your Press Production!

Littell engineered to fit readily on standard straight sided and OBI Presses. Feed thick or thin stock up to 72" wide at the speeds required for new efficiency and economy in your stampings production.

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Branches: Detroit Cleveland

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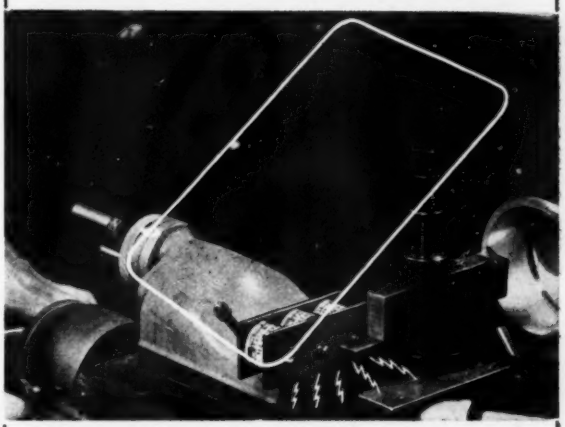
Magnetic MACHINE TOOL GUARDS



. . . will control your shop-flak and stop those missile-like chips from making you their target. Powerful Alnico magnetic bases,—regular or giant size,—position five sizes of clear plastic shields where needed. Popular size, 8" x 10", with regular base @ $9.25; with giant base @ $15.95 f.o.b. your plant in USA.

ORDER TODAY! Write for literature — try them!

The DILLEY *Manufacturing Company*

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Cut MACHINING COSTS With

MAXWELL CARBIDE "THROWAYS"

Adjustable BORING & REAMING Cutters

USE Carbide Inserts

Replace Tips Only!

Cutters Easily Adjustable

Index Carbide FOUR times and SAVE

Ask your Maxwell representative or write

No need to buy new holders when carbide is worn. Save time, save money with MAXWELL *adjustable* boring and reaming cutters—index carbide for FOUR cutting edges.

Maxwell adjustable cutters fit ANY standard boring or reaming bars. Cutting capacities—1 3/4" to 6"; accommodate carbide tips: 3/8 x 3/8" to 1 1/8 x 3/8".

A-928A

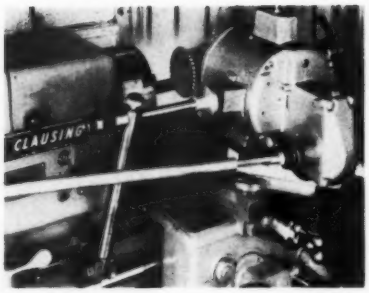
MAXWELL INDUSTRIES, Inc.
493 E. 5th St. Ashtabula, O.

CIRCLE INFORM-A-GRAM KEY NO. 1174

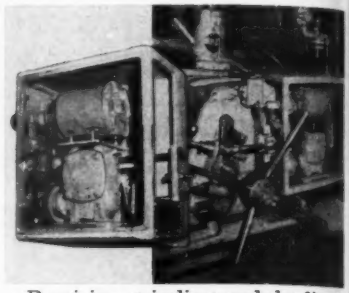
Product News

Unique Thread-Miller

Set up for production runs in 5 min, using this unique thread-miller that'll fit any lathe. It duplicates every operation of costly threading machines and there are no complicated thread chasers to set or special grinding of threading tools. Thread cutting is completed in one pass, without distortion or runout, and the pitch and root dia and pitch angle are held to a close tolerance of 0.001". For details, contact Fenway Machine Co., Inc., 3107 N. Broad St., Philadelphia 32, or Circle Inform-A-Gram No. P39.



Infeed Grinding Attachment

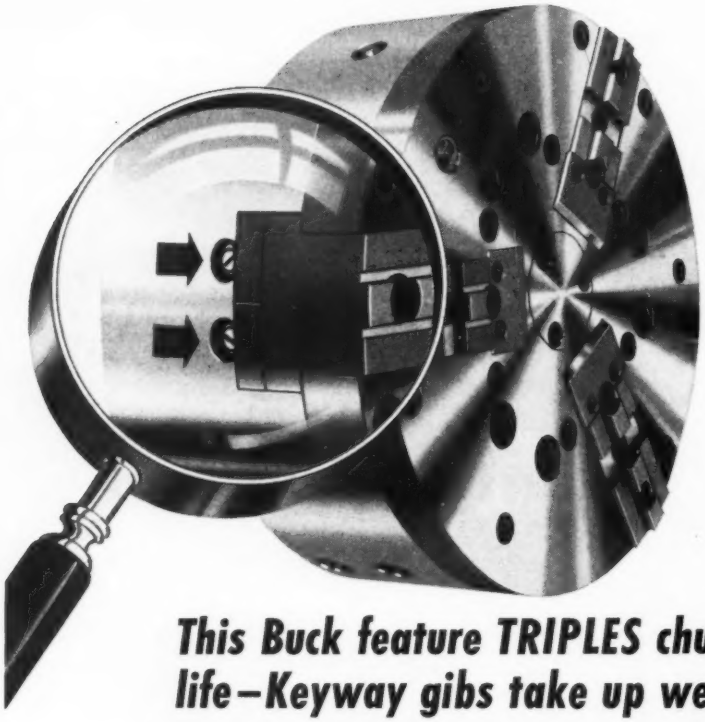


Precision grinding and duplicate sizing with wide variable feed rate of 12 to 40 pcs/min, depending upon tolerance and finish desired, are possible with the new automatic Lo-Die centerless grinder infeed attachment. It boasts a controlled grinding and dwell cycle that removes stock and holds finish constant. Lordstown Tool & Die Co., Inc., R. D. 2, Warren, Ohio, supplies details, or Circle No. P40.

New 180 Amp Welder

Immediate arc welding repair is possible with the installation of this new portable 180 amp welder. Dial-type control provides easy positive setting of the welder output over a wide amperage range. Electrodes from the smallest to 3/16" size can be used to weld materials from 20 ga to 1/2" or thicker plate. For details, write The Lincoln Electric Co., Cleveland 17, or Circle Inform-A-Gram No. P41.

Take a CLOSE Look!



This Buck feature TRIPLES chuck life—Keyway gibs take up wear

You have some unbeatable profit-making features going for you with Buck Aluminum Body chucks. The easily-adjusted gibs to take up wear and prevent bell-mouthing are just one advantage.

Aluminum body and new design master jaws *save 40% of conventional chuck weight* . . . increase efficiency, save machine wear.

.001" precision is guaranteed by the famous Buck Ajust-Tru principle that permits *machining jaws in the tool room* and final precision adjustment *under full gripping pressure.*

Front plate, ways, master jaws, gibs are all hardened and ground and thoroughly lubricated.

These unique new power chucks are another reason why—"You make money every time you chuck with Buck." Send for a catalog—see for yourself.

Aluminum Body power chucks are available in diameters up to 18". Also see the Scroll, Independent, Dust-Proof, and Gear chucks.

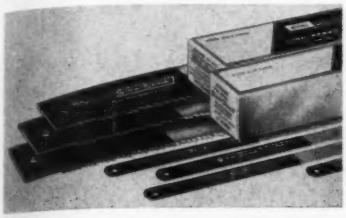
BUCK TOOL COMPANY

318 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 118

Product News

Efficient Cutting Blade



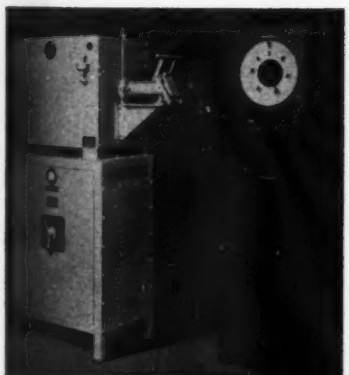
A 50% saving in blade cost is possible using the new Silver Streak high speed hacksaw blades. Both the hand and power blades have this more efficient and more durable cutting edge. Contact Atkins Saw Div'n, Borg Warner Corp., 402 S. Illinois, Indianapolis 9, for details, or Circle Inform-A-Gram No. P42.

Injection Molding Unit

For injection molding of all thermo-plastics, use the new Mitey-Jecter, especially designed for low production or prototype work. It operates from 110-v outlet. Pressure is exerted to 12,000 psi and capacity is 1/4 oz. Literature available from Automation Tool Inc., P. O. Box 331, La Jolla, Calif., or Circle Inform-A-Gram No. P43.

High Temp Furnace

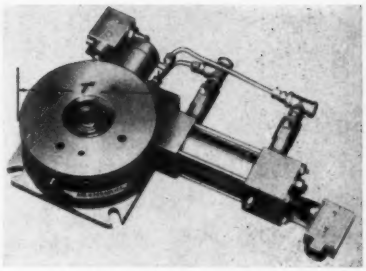
For processing work at temperatures up to 3000°F, use the new tubular element furnace line that handles sintering, brazing, heat

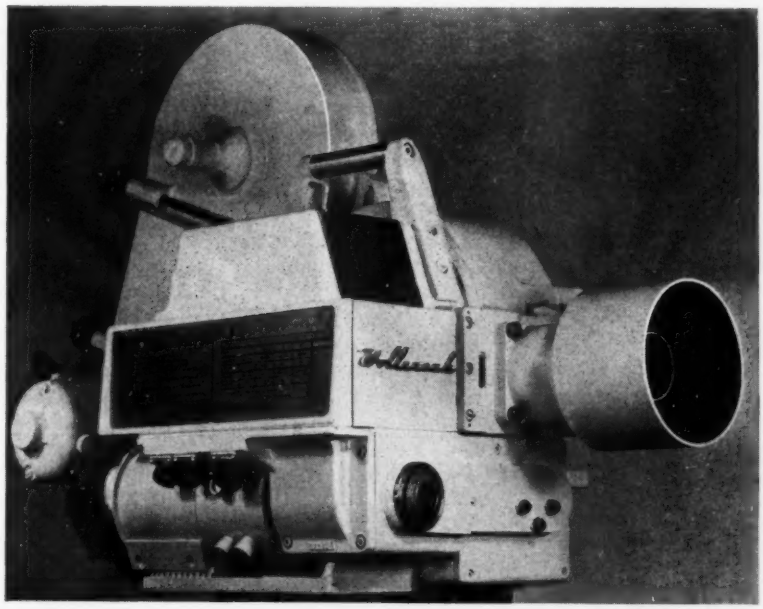


treating, and bright annealing jobs. Economical production of contacts, pivots, and ceramic resistors are possible with it. Get Bulletin GT-1059 from Harper Electric Furnace Corp., 110 Pearl St., Buffalo 2, N. Y., or Circle Inform-A-Gram No. P44.

Small Index Table

This new heavy-duty 7" index table, although small, has the features found in the larger models. It makes up to 75 indexes/min and handles a 100 lb maximum work load. Maximum power stroke is three times line pressure. Get details from Air Hydraulics, Inc., 644 Hupp Ave., Jackson, Mich., or Circle Inform-A-Gram No. P45.





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- Pushbutton speed selection.
- Rotating prism and high efficiency co-axial drum shutter.
- Rapid acceleration; flat speed curve within ±4% selected rate.
- Three optically projected Fiducial Markers.
- 400' daylight magazine, standard 35mm film; negative or positive perforations.
- Thru-the-lens viewfinder . . . boresight available for metric work.
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You get truly superb resolution—blur-free pictures at highest speeds—with the WF-8A 35mm Full Frame Metric High Speed Camera.

And so easy to use! No changing of motors and gears for different speeds, because unit is completely self-contained. Just load up and shoot at any of 8 speeds from 200 to 2000 p/p/s. You'll see more detail on the film than ever before . . . in full frame size!

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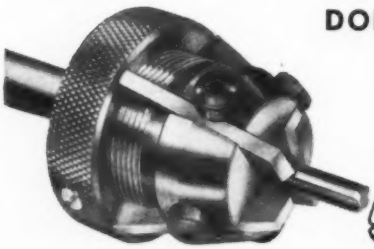
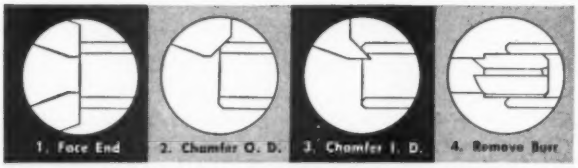
DOES 4 JOBS AT ONCE



ROUGH END . . .

BRASS • COPPER
STEEL • ALUMINUM

. . . TO FINISHED END



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- Replaceable pilot reamers
- Adjustable for size control
- Easily reground in your plant

Standard sizes for 3/16" to 1-1/4" tubing.

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566 HOLLENBECK ST. • ROCHESTER 21, N. Y.

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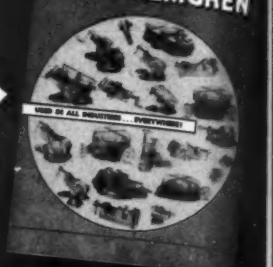

Drill press vises, angle vises, swivel machine vises, rotary tables, lathe milling attachments, production vises, heavy duty angle vises, and adjustable angle plates are illustrated and fully described in the New Palmgren Catalog. This is the only complete line of work holding devices available anywhere. Designed for production, tooling, and maintenance work, there are 68 different models and types to choose from. Vise jaw sizes are from 1½" to 8". Ask for your copy of this FREE Catalog No. 205 today. The complete line with details and prices are shown.

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by CHICAGO TOOL AND ENGINEERING CO.

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HI-ROC CARBIDE DRILLS

Give these FORD "HI-ROC" drills a trial run in your shop. See how many *more* accurate holes you will drill before regrinding is necessary . . . even in metals to 65 R.C. and 280,000 PSI tensile. Choose from 50 standard sizes in lengths from 1½" to 7" . . . or have FORD engineers design and produce "HI-ROC" drills, ground from solid carbide, to your specific requirements.

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Rotary FORD Tools

M. A. FORD MFG. CO., INC. Dept. TP-360

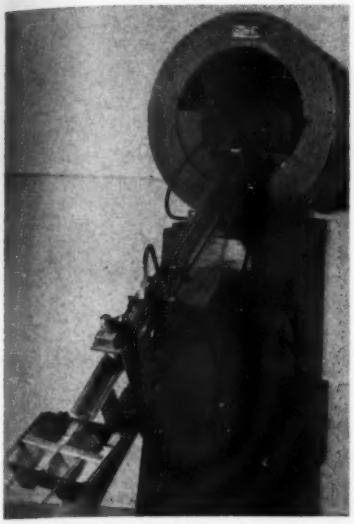
1545 Rockingham Road, Davenport, Iowa

Manufacturers of Precision Cutting Tools

CIRCLE INFORM-A-GRAM KEY NO. 1204

Product News

Versatile Sorter



A new electronic sorter orients and segregates drill blanks, turned machine parts, and similar items. It can sort drill blanks into two groups so that the points are all leading or trailing. Changeover is done in minutes. Contact The U. S. Engineering Co., 40-24 22nd St., Long Island City, 1, N. Y. or Circle Inform-A-Gram No. P46.

Motorized Fixture

This compact, precision, motorized fixture permits through-feed or form grinding operations on cylindrical parts with conventional surface grinders. The Mini-Grind fixture's design provides concentricity and avoids the use of centers, chucking devices, or indicators. It's ideally adapted to production of precision forms on cylindrical parts from 0.005" to 3" dia. Write Products Supply Co., 1178 Woodward Heights Blvd., Ferndale 20, Mich., for details, or Circle Inform-A-Gram No. P47.

Low-Cost Coolant Cleaner

This highly - efficient low - cost all-purpose coolant filter uses fabric as a filter medium and handles all materials — magnetic or non-magnetic, as well as grinding wheel grit and atmospheric dust and dirt. It can be applied to grinders, electric spark disintegrators, and diamond reclamation systems, to name a few. For details, contact The Kebby Co., 2320 Custer Ave., Rockford, Ill., or Circle Inform-A-Gram No. P48.

Get CARBIDE PERFORMANCE at TOOL STEEL COST...

Ferro-Tic* (with proven performance)

the only machinable carbide in existence!

FOR: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc.

FERRO-TIC combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed steel tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750° F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing carbide components, using available tools and skills without delay!

FERRO-TIC can be turned, drilled, milled, sawed, tapped.

AGENTS THROUGHOUT THE U. S. A.

WRITE FOR ILLUSTRATED BULLETIN P3

Sintercast

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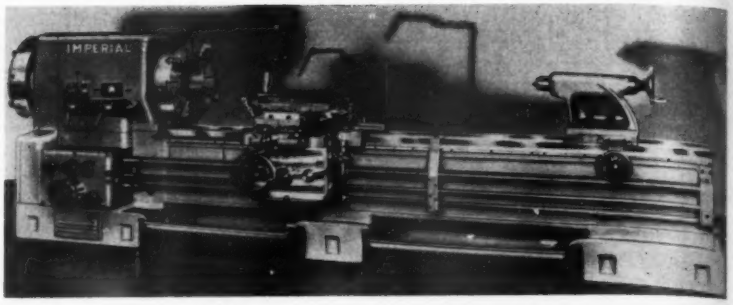
CIRCLE INFORM-A-GRAM KEY NO. 121

Product News

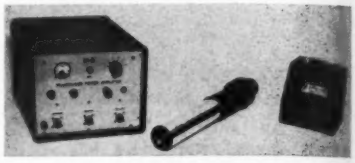
New Lathe



This Lathe's gear box supplies 60 different feed changes, with ranges from 0.0047″ to 0.260″. The spindle has forward and reverse rotation through multiple disc clutches, and 8″ travel. The headstock is 9¼″ dia. The tailstock is 3⁹⁄₁₆″ and the cross-slide travel is 25½″. Get details from Aaron Machinery Co., Inc., 45 Crosby St., New York 12, or Circle No. P49.

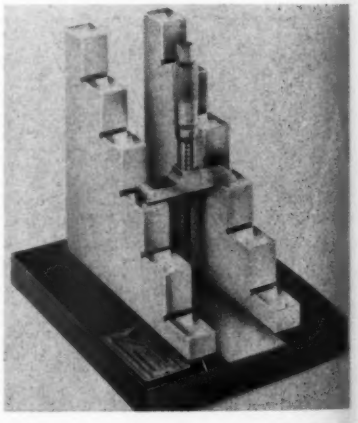
Electronic Auto-Collimator

This unit's capable of measuring the tilt of a reflective surface with respect to the auto-collimator axis to a sensitivity approaching 1/50 sec. It's ideal for checking flatness



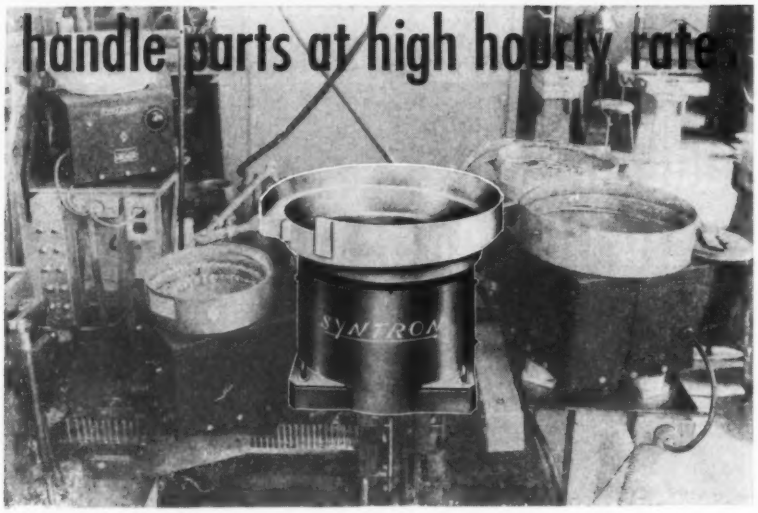
of surface plates, monitoring drift of gyros, checking straightness of machine ways, and checking run-out of precision bearings. Write Optics and Metrology Div'n, Keuffel & Esser Co., Third and Adams Sts., Hoboken, N. J., for details, or Circle Inform-A-Gram No. P50.

Depth Mike Setter



To assure accuracy of depth mike settings, proper setting and adjustment of rods, and to eliminate scrap caused by improper measurements, use the Depth-Mikemaster. Its got an accuracy of 0.001″ on each step and a range of 0.500″ to 5.500″ in six steps. Get details from Size Control Co., 2500 W. Washington Blvd., Chicago, Ill., or Circle No. P51.

SYNTRON cost-reducing equipment of proven dependability



SYNTRON Vertical Vibratory
PARTS FEEDERS

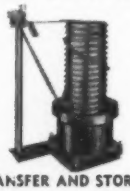
. . . replace manual methods of handling small parts . . . handle parts of almost every size, shape and material at high instantly controlled rates to tapping, counting, inspecting, tooling, centerless grinding, stamping machines, and other operations.

SYNTRON Parts Feeders offer dependable, high count, single file feeding of parts. Designed for efficient, dependable service with little or no maintenance.

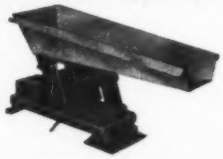
Write for free literature on SYNTRON Parts Feeders

SYNTRON COMPANY
341 Lexington Ave. Homer City, Penna.

Other SYNTRON Equipment of proven dependable Quality

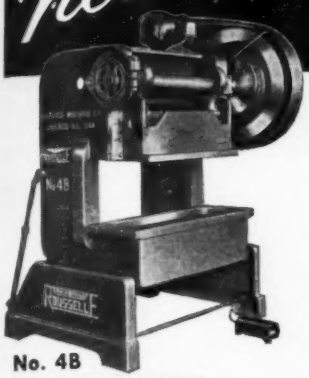

TRANSFER AND STORAGE

BIN VIBRATORS


VIBRATORY FEEDERS

CIRCLE INFORM-A-GRAM KEY NO. 122

New 40-TON DOUBLE CRANK O. B. I.
ROUSSELLE



WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
- Bronze main and crank bearings.

No. 4B ROUSSELLE PRESS

CHOICE OF 30 SIZES AND TYPES IN 5 TO 40-TON PRESSES

SERVICE MACHINE CO.
Mfrs. of Rousselle Presses
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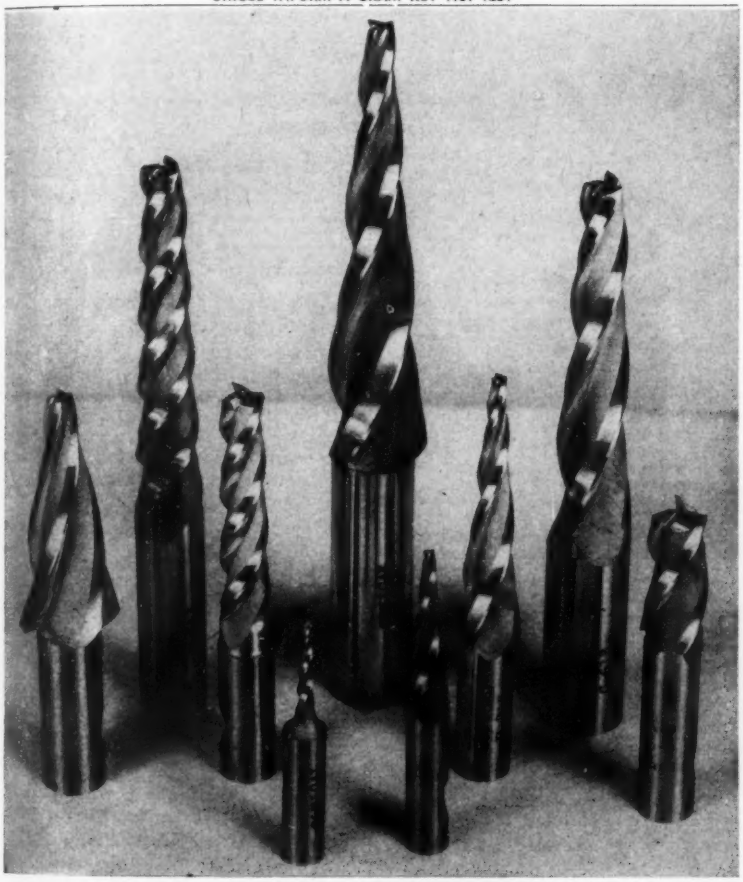

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CONICAL TOOL CO. 3890 Buchanan S.W. Grand Rapids 8, Michigan

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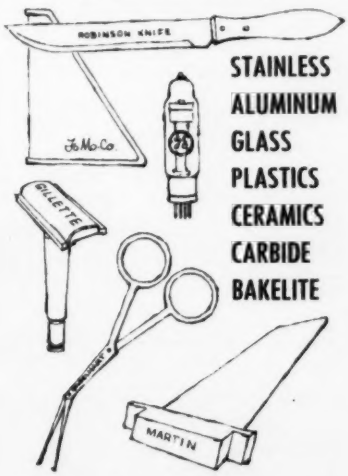
Marks gently permanently on



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"Airgrit" marks the hardest, most polished surfaces with not much more than a breath of air.

Send a sample of your product to be "Airgrit" marked.

JAS. H. MATTHEWS & CO.
3962 FORBES AVENUE
PITTSBURGH 13, PA.

CIRCLE INFORM-A-GRAM KEY NO. 1233

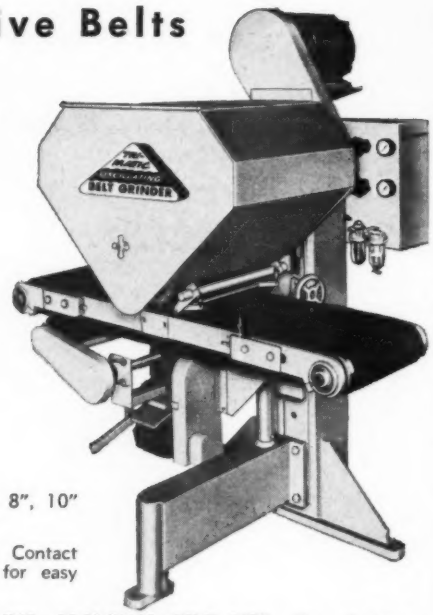
NEW TRI-MATIC Oscillating Belt Grinder

deburrs, descales, grinds, polishes . . .

Change Abrasive Belts

IN LESS THAN

2 MINUTES



BELT TRACKING adjustments are completely eliminated. No projecting belt guides interfere with sliding one belt off and another on. It takes less than 2 minutes from turning off the machine to re-starting.

4 MACHINE SIZES IN 1 A simple adjustment permits use of 6", 8", 10" or 12" wide belts.

EASY CHANGE CONTACT WHEELS Contact wheel and mount are one unit for easy changing.

OSCILLATING BELT SPEEDS GRINDING, PROLONGS BELT LIFE The shearing action of the abrasive belt makes it cut faster, clean itself better, reduces grinding pattern to a minimum and makes belts last longer. Variable speed conveyor adds to versatility. AVAILABLE in 12", 18", 24" and 30" models.

Write TODAY for illustrated descriptive Bulletin TM-459.

TRI-MATIC DIVISION

Send problem parts to our abrasive engineers for processing and suggested solutions. No obligation.

Sales Service Mfg. Co.

2361 University Avenue, St. Paul 14C, Minnesota

CIRCLE INFORM-A-GRAM KEY NO. 1241

HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

Many uses —

—core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

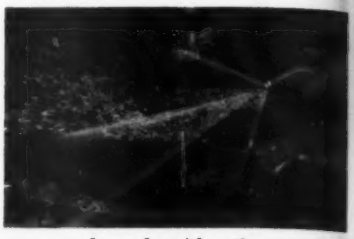
WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1242

Product News

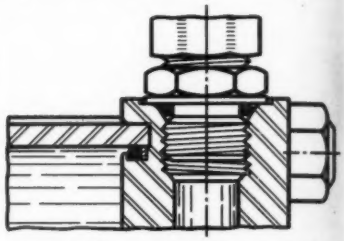
New Air Nozzle

Here's a new air nozzle that combines full power with complete operator protection from flying chips. An invisible shield of air



surrounds and guides the powerful jet stream, yet prevents chips from showering the operator. Get booklet from Halortha Engineering Co., Inc., P. O. Box 20, Windsor, Conn., or Circle Inform-A-Gram No. P52.

Hydraulic Cylinder Series



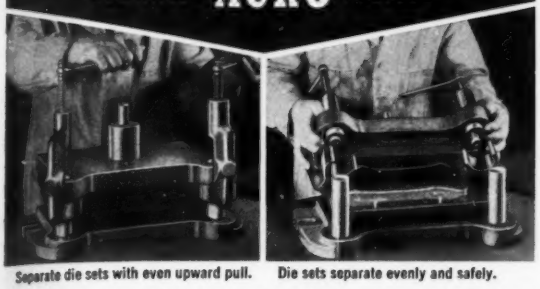
Straight thread cylinder ports on the new Series H hydraulic cylinders eliminate many leakage problems. Other benefits include no distortion due to the wedging action of a pipe thread connection and elimination of pipe dope. Get data from Hannifin Co., Dept. 164, 501 S. Wolf Rd., Des Plaines, Ill., or Circle Inform-A-Gram No. P53.

One-Man Tightening

This double-handle torque wrench permits one-man tightening and is excellent in confined spaces because less than 3/4" rotary travel gives a total torque range of 100 in-lbs. Model TDF-100, both left and right, has an alloy steel bar that retains its setting despite rough usage. Model TDF-600 is also available from Apco Mossberg Co., 1010 Lamb St., Attleboro, Mass., or Circle Inform-A-Gram No. P54.

FOR EASY, FAST UNIFORM SEPARATION OF DIE SETS...

USE THESE **ACRO** PULLERS



Separate die sets with even upward pull. Die sets separate evenly and safely.

When you have die set pullers that remove the punch holder from the die shoe by a straight upward pull and the punch holder slides upward from the die shoe simultaneously and safely from both leader pins, you have Acro Die Set Pullers and you're saving time.

If you're not, this is how it's done with Acro Pullers: *Indexed* screw wrenches act as indicators, controlling the upward travel. This is an exclusive patented Acro feature and found only in ACRO DIE SET PULLERS. It may pay you to investigate. Write for further free information today.

OTHER* ACRO *TIME SAVERS FOR YOUR SHOP include Acroflex, drill rod racks, leader pin oilers and wing nuts. Write for complete descriptive folder. Ask for bulletin TP59.

ACRO METAL STAMPING COMPANY
3387 E. Reservoir Ave., Milwaukee, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 1251

SIX ADVANTAGES OF MEIER WEARITE EXTRUDED ALUMINUM BRONZE RECTANGLES

for wear strips and wear plates

LENGTH: MEIER WEARITE is available in any length up to 10 feet.

AVAILABILITY: WEARITE comes right off the shelf of your local distributor... no waiting time for sizes now in stock.

SIZE: 94 different rectangular sizes 1/4" to 3" thick and 1" to 6" wide.

QUALITY: WEARITE is produced under strict laboratory controls. Tough (210–307 Brinell); strong (105,000 psi ultimate yield); and smooth surfaces with excellent wear characteristics.

MACHINING: Extruded WEARITE is free from porosity, and inclusions and has a homogenous structure, improving machineability.

COST: MEIER WEARITE COSTS LESS in pound for pound of usable metal than cast wear strips.

Write for technical folder or test sample at no cost.

Meier BRASS & ALUMINUM Company
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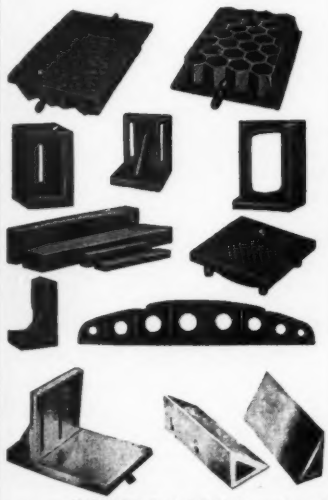
HAZEL PARK, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1252

DEPENDABLE ACCURACY



INSPECTION TOOLS made of MEEHANITE METAL are designed to fill your various Inspection and Checking needs. Sturdily constructed to give you reliable, accurate service.

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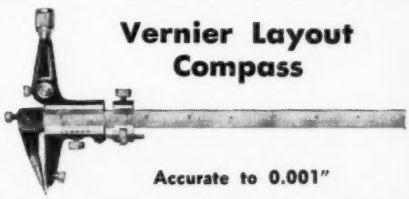
CIRCLE INFORM-A-GRAM KEY NO. 1253

Vernier Layout Compass



Accurate to 0.001"

Invaluable for laying out circles and radii—for template layout and optical comparator charts. Two sizes: 6 inch and 12 inch. Scales read to 1/1000 inch. Packed in wood case including Phonograph needle points and scriber. Write for literature.

Dealer inquiries invited

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CIRCLE INFORM-A-GRAM KEY NO. 1254

WHY WAIT! Immediate Delivery From THE LARGEST STOCK OF SPECIAL RH & LH

Taps-Dies & Thread Plug Gages

Also in Stock:
- RING GAGES
- ACME & METRIC TAPS & DIES
- SPECIAL REAMERS
- EX. LONG DRILLS

Write for WALL CHART Listing Sizes

Special Taps Also Made to Your Print Specifications

* Quotations on Request *

FIELD TOOL SUPPLY CO.
Industrial Cutting Tools
31 S. DESPLAINES ST., CHICAGO 6, ILL.
All Phones: Financial 6-1195

CIRCLE INFORM-A-GRAM KEY NO. 1255

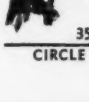
NEW 5" Hinged Sine Plate features 6¼"x6¼" WORKING SURFACE with 3 T Slots

No. 1806
$195.00 with oak case

Positive locking provides rigid set-up for light machining operations. .2000" recess in base makes small angle set-ups easy. Precision ground base and body and hardened rolls insure accuracy. Heavy end and side plates. A precision tool at LOW COST.

No.	Cent. Dist.	Width	Price W/ Case
1805	5"	3"	$109.50
1806	5"	6¼"	195.00
1810	10"	5"	265.00

F.O.B. St. Paul



Choose your sine bar or sine plate from the complete Bald Eagle line starting at $26.50. Order from your dealer or direct

Bald Eagle Prod. Div.
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CIRCLE INFORM-A-GRAM KEY NO. 1256

* Acme Industrial figures your time is money. So . . . Acme saves it for you. The FREE Lock Screw Locating Jig instantly gives location for lock screw drilling and tapping. Handy? You bet. Free? Honest. A daily time and work saver? Certainly. No, Acme bushings (all 30,000 sizes of them) aren't free, too. But just as important, they're close as your nearby Acme distributor. Fastest delivery standard . . . finest quality (a tradition) expected . . . dependable precision remarkably perfect.

what.... a FREE lock screw locating jig! *

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204 North Laflin, Chicago 7, Ill.

SAVE... my time and work! Send me a FREE Lock Screw Locating Jig. No obligation, of course.

☐ Send your bushing catalogs, too.

Name_____
Firm_____
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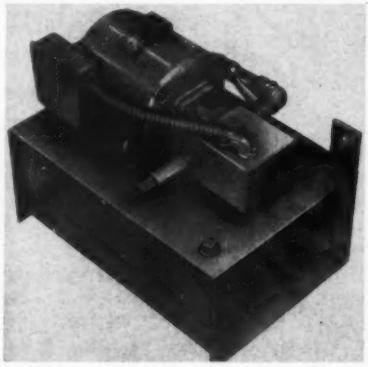
CIRCLE INFORM-A-GRAM KEY NO. 1261

Product News

Low-Cost Hydraulic Package

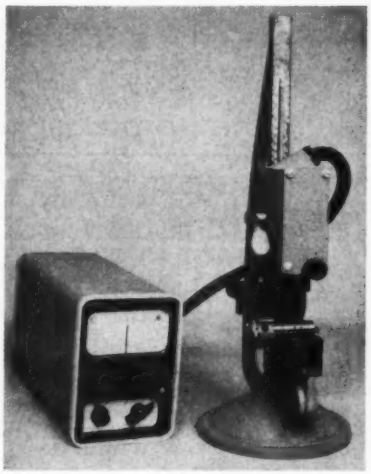
A new low-cost hydraulic package is adaptable for press and machine feeding, lift tables, or for any



other intermittent or jog applications. The Auto-Power package provides 1½" gal/min output at 2000 psi to handle these jobs. Write Autoquip Corp., 1140 S. Washtenaw, Chicago 12, for details, or Circle No. P55.

New Electronic Comparator

For high precision checking and inspection work; calibrating gage blocks, masters, etc.; checking parallelism and ball sphericity;



and checking production runs, use this new electronic comparator. The Sensitron features a new double capacitance gage head that eliminates electronic drift regardless of changes in the atmosphere. Write Electro-Autosizing Machine Corp., 7 William St., Closter, N. J., or Circle Inform-A-Gram No. P56.

* Dream? My foot! Hydrive proved it! Doubles . . . and can even triple your manually operated turret lathe output! Adapts to bench type and up to No. 5's. A flick of a finger automatically controls: cross slide/spindle speed/bar stock handling/spindle rotation direction for tapping collet opening and closing! Once set, Hydrive never varies a fraction from first piece to last. Think what Hydrive Automation will mean to your output . . . then contact Acme Industrial . . . soon!

I dreamed I doubled production... with HYDRIVE *

ACME INDUSTRIAL COMPANY
204 North Laflin, Chicago 7, Ill.

YES... I want to know how HYDRIVE will multiply our production, more than pay for itself in no time.

☐ Send complete HYDRIVE literature
☐ Have the Acme representative call on me
☐ We'd like to see the informative Hydrive film

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Firm_____
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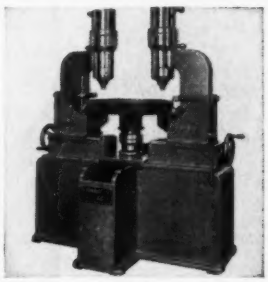
CIRCLE INFORM-A-GRAM KEY NO. 1262

"Hy-Power" by HANNIFIN
5,000 PSI HYDRAULICS

Proved by more than 25 years use in the Automotive Industry

• BETTER THAN EVER TODAY •



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Used on trucks, trailers, automobiles and throughout industry

Used for riveting, punching, pressing, marking and press-fit assembly

LIGHTWEIGHT PORTABLE TOOLS
GAP OR COLUMN PRESSES • POWER UNITS • CYLINDERS
STANDARDS AND SPECIALS

In use throughout the world

Call in your nearby Hannifin man—he's a trained production analyst—find out how you can do more at lower cost with Hannifin "Hy-Power." Or write for our new Bulletin 150-A. It tells the whole story.

HANNIFIN COMPANY
563 South Wolf Road • Des Plaines, Illinois

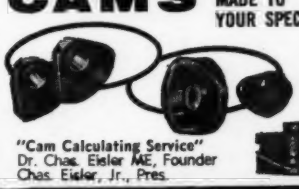
A DIVISION OF PARKER-HANNIFIN CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 1271

BOOKS

A COMPLETE LINE OF TECHNICAL BOOKS ARE AVAILABLE. COMPLETE INFORMATION, INCLUDING DESCRIPTIONS, TITLES, AND PRICES ARE SHOWN IN THE HUEBNER PUBLICATIONS ADS ON PAGES 78, 80, 82 AND 83.

CAMS ALL TYPES MADE TO YOUR SPECS



"Cam Calculating Service"
Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC.
752 SO. 13TH ST. NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1272

New "Driving Center" Introduces Faster Machining Techniques on work Held Between Centers

Eliminates Chucks and Clamps... Permits Full End-to-End Machining... "Loads" or "Unloads" without Stopping

A new development to increase both output and accuracy, the Ideal Driving Center grips the end face of the work and so eliminates entirely the need for chucks, dogs or other bulky clamping devices.

New machining techniques and remarkable cost savings are thus made possible. Chucking time is completely eliminated and work may be machined from end to end without removal or change. Usually the machine can be loaded and unloaded without stopping, which substantially reduces wear on motors, belts, gears and clutches.

Quality of work is generally improved, because rigid direct-drive action reduces backlash and eliminates slippage. Precision indexing on gear hobbers and mills is simplified.

Preliminary machining is unnecessary; self-compensating pins grip and hold non-uniform work-ends — even odd-shaped pieces that cannot be held by other means.

Lathe or other machine operators do not have to learn difficult new methods. The Driving Centers are available in catalog models providing 63 combinations to fit maximum work diameters from 7/8" to 6 3/8", in Morse tapers 2 to 6. Larger sizes may be had as "specials".

Complete details of operating principle and selection chart will be sent without obligation. Mail coupon below to

IDEAL INDUSTRIES, Inc.

IDEAL

IDEAL INDUSTRIES, Inc.
1334-C Park Ave., Sycamore, Ill.

Please send me complete engineering data and selection chart for IDEAL Driving Centers.

Name_____

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CIRCLE INFORM-A-GRAM KEY NO. 1273

CUMULATIVE EDITORIAL INDEX FOR 1960 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this useful index.

The Publisher

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1 operation—
instead of 2!

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Dept. TP-3

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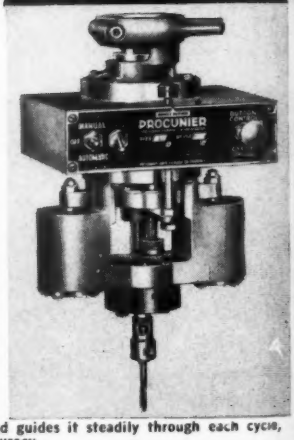

with Finger Tip Push Button Controls permits you to tap any quantity of practically any material, with absolute precision, without rejects, without stripped threads or distortion. Tests have shown it produces parts that pass 100% inspection — 100% acceptable! The secret is in the tap control mechanism which feeds the tap automatically without any pressure. The Lead Screw controls the tap and guides it steadily through each cycle, guaranteeing supreme accuracy.
In addition, it offers convenient 5-way operation; pushbutton and foot control for complete cycle or jog automatic (without foot or hand controls) or with switch fixture for full cycle. Either way, you get uniformity, speed and precision that's unparalleled!

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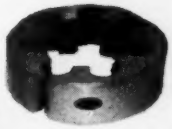

SPECIAL Right & Left Hand High Speed Taps - Dies & Thread Plug Gages

SIZE	THREADS PER INCH
0000	160
000	120
00	90-96-112
0	56-64-72-76-80-90
1	48-56-60-64-80-90
2	48-52-54-56-60-72-80-96
3	36-40-60-64-72-80
4	30-32-38-42-44-56-60-64-72-80-90
5	22-27-30-32-36-38-42-48-50-56-60-64-72-80
6	24-28-30-36-38-42-44-48-56-60-64-72-80
7	28-30-32-34-36-38-40-48-64
8	24-26-28-30-38-40-44-48-56-60-64-72-80
9	24-28-30-32-36-40
10	18-20-22-26-28-30-34-36-40-48-56-60-64-72-80-96
11	20-22-24-28-30-32-36
12	20-22-26-27-30-32-36-38-40-48-56-60-64-72-80
13	20-22-24-28-32
14	14-16-18-26-28-30-32-36-40-64
15	18-20-24-28-32
16	16-18-20-22-24-28-32-36
17	16-20
18	16-18-20-24-32-40
19	18-20
20	14-16-18-20-24-32
22	16-18-20-24
24	14-16-18-22-24
26	14-16-20-24
28	14-16-20
30	14-16-20
1/16	56-60-64-72
5/64	56-60-64-72
3/32	32-36-38-48-50-56-60-64
.100	100
.107	52
7/64	36-40-42-44-48-50-56
1/8	30-32-36-38-40-48-56-60-80
.132	50
9/64	30-32-38-40
.140	38
5/32	24-26-28-30-32-36-38-40-50
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-27-28-30-32-36-40-48-56-64-72

SIZE	THREADS PER INCH
.198	24
13/64	24-28-30-32-36-40
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-22-24-28-32-36-40
1/4	10-12-14-16-18-22-23-24-25-26-27-30-32-36-38-40-48-50-56-60-64-72-80
17/64	12-18-20-24-27-28-32-40
.277	40
9/32	16-18-20-24-26-27-28-32-36-40-46-56
19/64	18-24
.300	28
5/16	10-12-14-16-20-22-26-27-28-30-32-36-40-44-48-50-56-64
21/64	16-18-20-24-36
11/32	16-18-20-22-24-26-27-28-32-36-40-64
23/64	16-24
.365	28
3/8	10-12-14-18-20-22-26-27-28-30-32-36-40-44-48-56-64
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27/64	14-20-24-28-32-36
7/16	10-12-16-18-22-24-26-27-28-30-32-36-40-48-56
29/64	12-14-16-20
15/32	12-14-20-24-27-28-32-36-40
1/2	10-11-12-14-16-18-22-24-26-27-28-30-32-36-40-44-48-56-80
33/64	12-13-20-24
17/32	10-12-13-14-16-18-20-24-27-28-32-40-64
.550	24
9/16	10-13-14-16-20-24-26-27-28-30-32-36-40-48-56-80
37/64	10-12-18-20-27
19/32	12-18-20-24-28-32-36-40
5/8	9-10-12-13-14-16-20-24-26-27-28-30-32-36-40-48-56-64

SIZE	THREADS PER INCH
41/64	11-18-24
21/32	10-11-18-20-24-27-32-40-48
11/16	10-11-12-14-16-18-20-22-24-27-28-30-32-36-40
23/32	11-12-16-18-20-24-27-32-36-40
47/64	10-12-16-18-20
3/4	8-9-11-12-14-15-18-20-22-24-26-27-28-30-32-36-40-48
49/64	10-16-18-20
25/32	10-12-16-18-20-24-27-32-40
.800	16
13/16	8-10-12-14-16-18-18-20-24-27-28-32-40
.835	16
55/64	6-12
27/32	9-10-18-20-24-27-32-40-48
.850	14
7/8	8-10-11-12-13-16-18-20-24-26-27-28-30-32-36-40
29/32	9-12-14-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-26-27-28-32-40
31/32	8-9-12-16-18-20-24-28-32
1	5-7-9-10-11-12-16-18-20-24-26-27-28-30-32-36-40-48
1-1/32	8-12-14-16-18-20
1-3/64	12-14-16-18-20
1-1/16	7-8-10-12-14-16-17-18-20-24-27-28-32-40
1-3/32	7-8-9-12-14-16-18-20-32
1-1/8	8-10-14-16-18-20-24-27-28-32-40-48
1-5/32	7-8-9-12-14-16-18-20-24-32
1-11/64	18
1-3/16	7-8-10-12-14-16-18-20-24-27-32-40
1-1/4	8-10-14-16-18-20-24-27-28-32-40
1-5/16	6-7-8-10-12-14-16-18-20-24-27-28-32-40-48
1-3/8	5-8-10-14-16-18-20-24-32-40
1-13/32	12-16-18-20
1-7/16	6-8-10-12-14-16-18-20-24-27-28-32-40

SIZE	THREADS PER INCH
1-1/2	7-8-9-10-13-14-16-18-20-24-27-28-32-40
1-17/32	7-12-16-18-20
1-9/16	6-8-10-12-14-16-18-20-24-32-40
1-5/8	5-5½-6-8-10-11½-12-13-14-16-18-20-24-28-32-40
1-11/16	8-10-12-14-16-18-20-24-32
1-23/32	5-8-12-16-18-20
1-3/4	5-6-8-10-12-13-14-16-18-20-24-28-32-40
1.767	18
1.7715	12
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	12-16-18-20-32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-28-32
2-1/16	8-10-12-14-16-18-20-24-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	8-10-12-14-16-18-20-24
2-1/4	4½-8-10-12-14-16-18-20-24
2-5/16	8-10-12-14-16-18-20-24
2-3/8	4-8-10-12-14-16-18-20-32
2-7/16	8-10-12-14-16-18-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	8-10-12-14-16-18-20
2-5/8	4-8-10-12-14-16-20-32
2-11/16	8-10-12-14-16-18-20-
2-3/4	4-8-10-12-14-16-18-20-32
2-7/8	4-8-10-12-14-16-18-20-24-32
2-15/16	8-10-12-14-16-18-20-32
3	3½-4-8-10-12-14-16-18-20
3-1/16	20
3-1/8	4-8-10-12-14-16-20
3-3/16	4-8-10-12-14-16-20
3-1/4	4-8-10-11-12-14-16-18-20
3-3/8	4-8-10-12-16
3-1/2	4-8-10-12-16
3-3/4	4-8-10-12-16
3-7/8	4-8-10-12-16
4	4-6-8-10-12-16
4-1/8	4-8-10-12-16
4-1/4	4-8-10-12-16

Many more sizes in stock up to 6" dia.

LEFT HAND N.C. (USS)—N.F. (SAE) SIZES

SEE ABOVE SECTION FOR MORE SIZES

SIZE	THREADS	SIZE	THREADS	SIZE	THREADS	SIZE	THREADS
0	80	8	32-36	7/16	14-20	1"	8-12-14
1	64-72	10	24-32	1/2	13-20	1-1/8	7-12
2	56-64	12	24-28	9/16	12-18	1-1/4	7-12
3	48-56	14	20-24	5/8	11-18	1-5/16	6-12
4	36-40-48	1/4	20-28	11/16	11-16	1-3/8	6-12
5	40-44	5/16	18-24	3/4	10-16	1-7/16	6-12
6	32-40	3/8	16-24	7/8	9-14	1-1/2	6-12

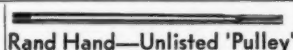
'OVERSIZE' and 'UNDERSIZE' TAPS

RIGHT AND LEFT HAND N.C. AND N.F. SIZES

MACHINE SCREW	#2 to #5	Plus or Minus	.002, .003, .005
MACHINE SCREW	#6 to #14	Plus or Minus	.003, .005, .010
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus	.003, .005, .010 .015, 1/64, 1/32

Right & Left Hand—Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
0	80 NF		
1	56 NS	7/8	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 12-14 NF
9/16	12 NC, 18 NF	1-1/8	7 NC, 12 NF
5/8	11 NC, 18 NF	1-1/4	7 NC, 12 NF
11/16	11 NS, 16 NS	1-3/8	6 NC, 12 NF
3/4	10 NC, 16 NF	1-1/2	6 NC, 12 NF



Rand Hand—Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	3/8	24-NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	1/2	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	5/8	18 NF
1/4	28 NF	3/4	16 NF
5/16	24-NF	Also Larger Sizes	NC & NF

UNLISTED Right Hand "Pipe" Taps

"NPT" Taper	"NPT" Size	Thread	"NPS" Size	Thread	EX. LENGTH "NPT" & "NPS" Size	Thread
1/16	27		1/16	27		
1/4	27		1	8		
2-1/2	8		1-1/4	11½	1/16	27
3	8		1-1/2	11½	1/8	27
3-1/2	8		2	11½	1/4	18
4	8		2-1/2	8	3/8	18
Also British			3	8	1/2	14
			3-1/2	8	3/4	14
			4	8	1	11½
			Also British		Also British	

Lefthand 'Pipe Taps' Taper and Straight

Size	Thread	Size	Thread
1/16	27	1	11½
1/8	27	1-1/4	11½
1/4	18	1-1/2	11½
3/8	18	2	11½
1/2	14	2-1/2	8
3/4	14	3	8
Also British		Also British	

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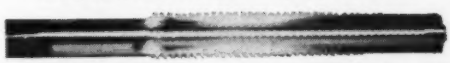

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(a) Kind of material being machined.
(b) Depth of hole in inches, through or bottom.
(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machined stopped for release of tap.
(g) If possible, submit thread length, and overall length of tap desired with blue print.

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New Ease in Hardness Testing

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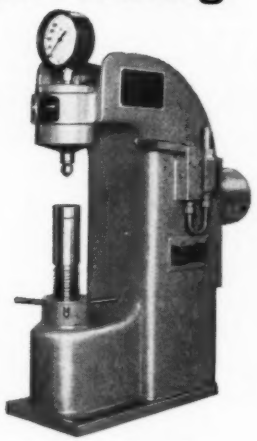
Now, even smaller shops can do Brinell hardness testing with a bench-mounted machine combining operating economy, control simplicity, high accuracy. Tests made with only finger-tip pressure. Operators cannot apply load too fast or overload. Stroke of ¾" permits anvil height to remain fixed when testing series of pieces of almost equal thickness. Load, provided by motorized hydraulic pump, is accurately controlled by time-tested relief valve. Load verified on sensitive hydraulic load gage.



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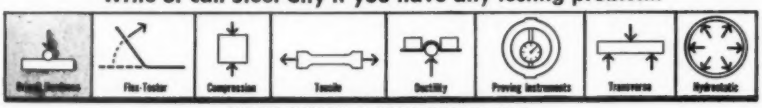

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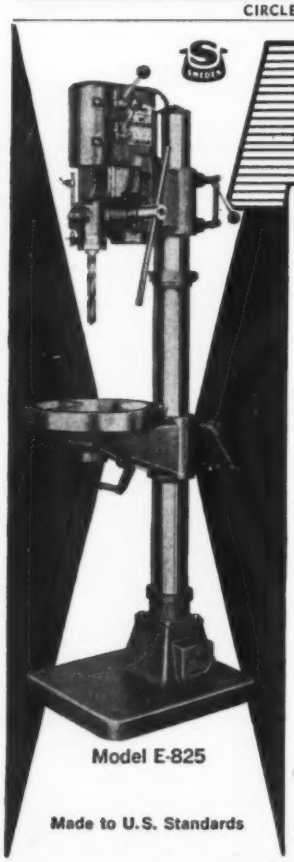

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ARBOGA

General Purpose DRILL PRESS

with Exclusive Drill Ejector

This is just one of the ARBOGA 1" drill presses. Model E-825 has eight speeds from 125 to 1540 rpm. The exclusive drill ejector makes this machine comparable with a multiple spindle press. Four- and twelve-speed heads are available as well as bench types.

Capacity in steel:	1"
Swing:	18"
Spindle travel:	4½"
Spindle taper:	#3
Diameter of column:	4"
Table size, standard:	14" dia.
Motor size, H.P.:	1.1/.8

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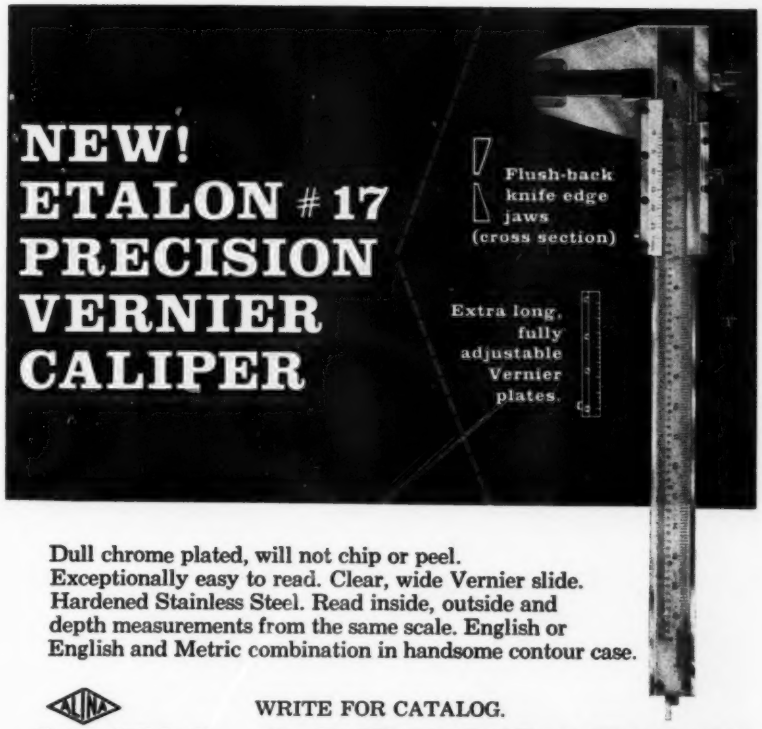

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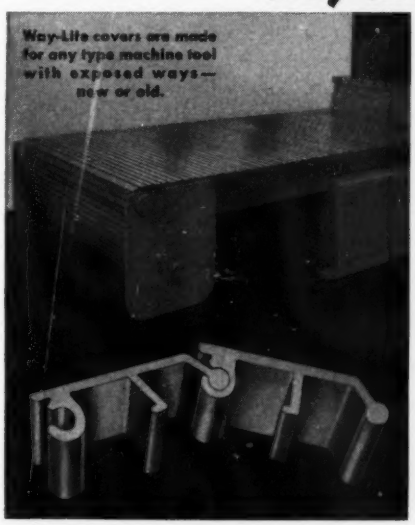

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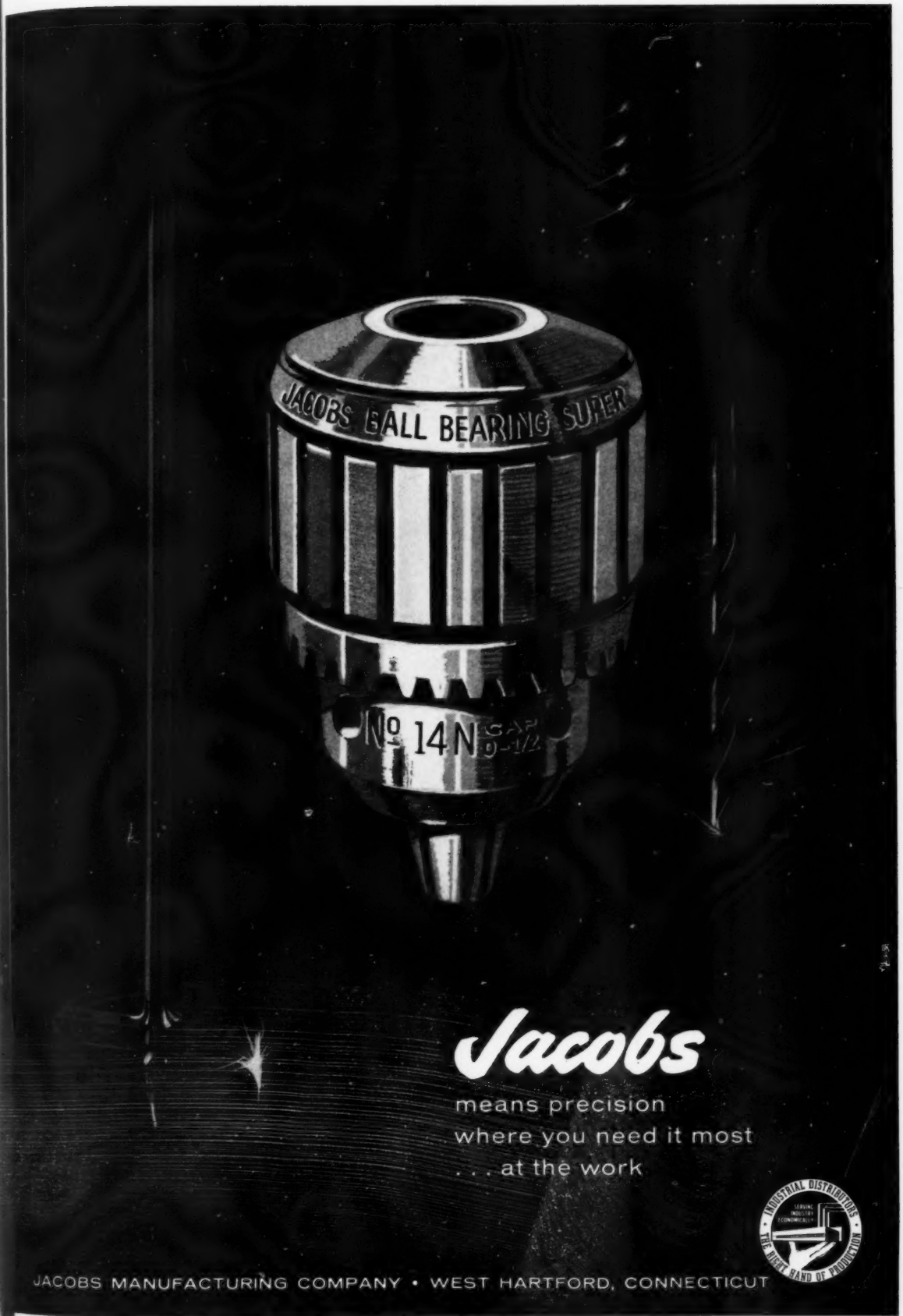

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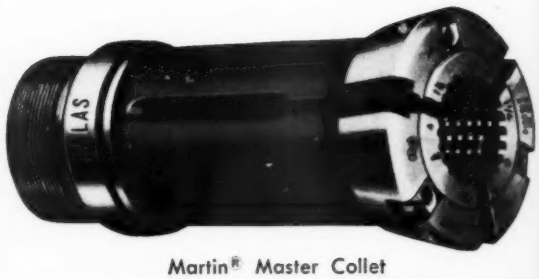

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